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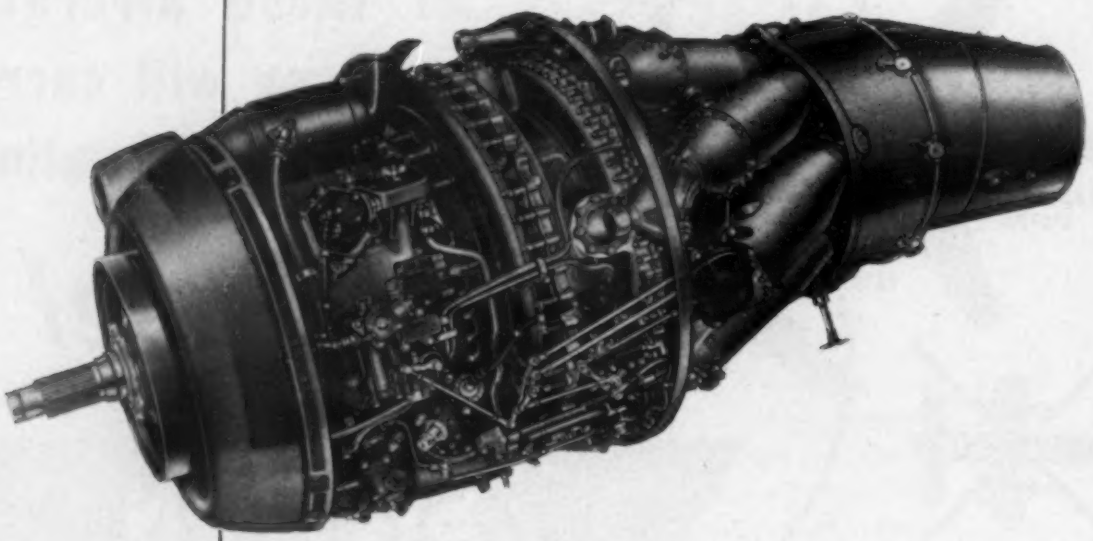

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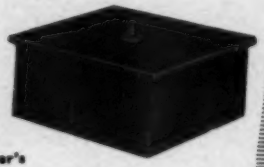

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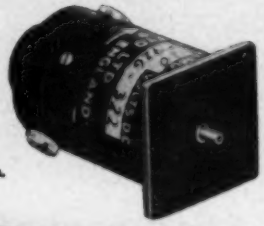

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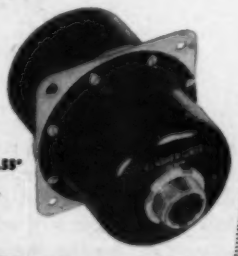

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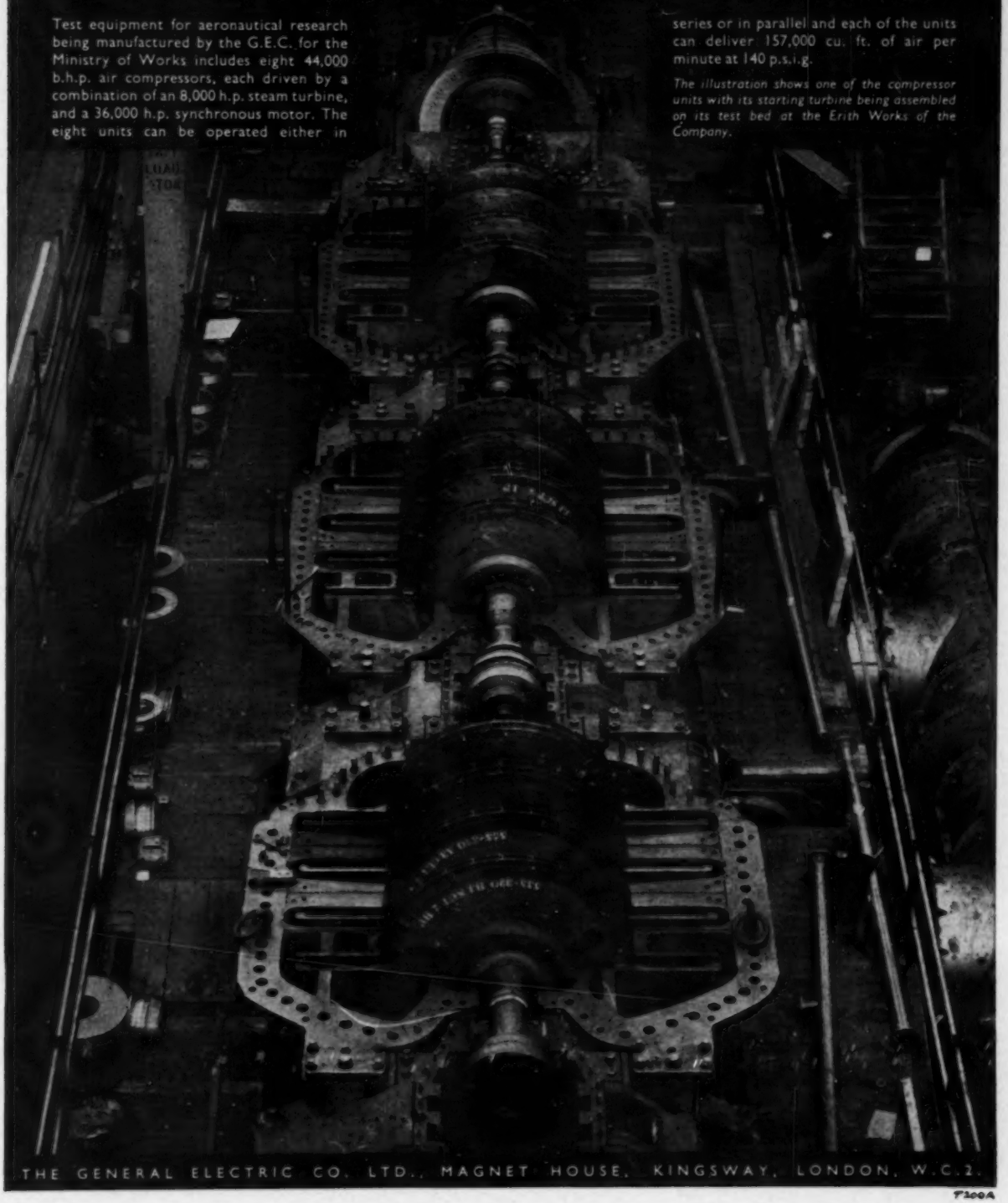

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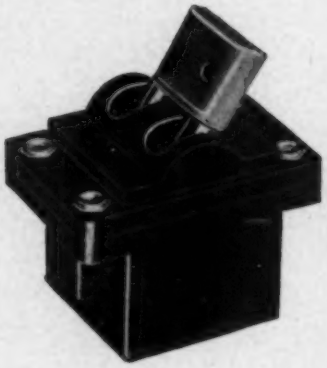

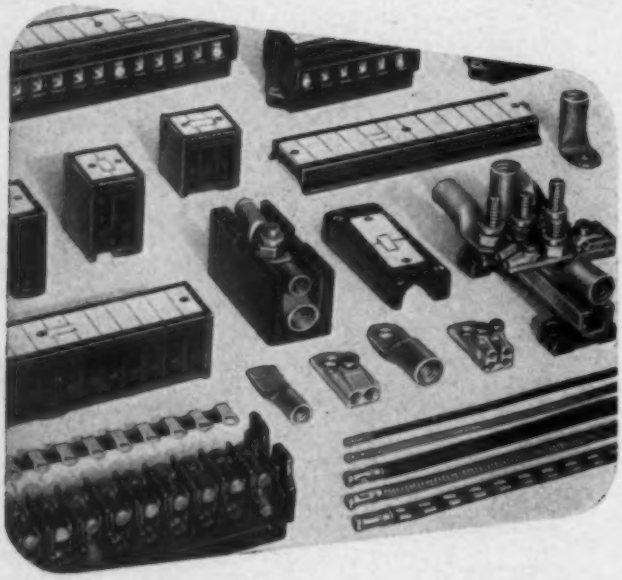

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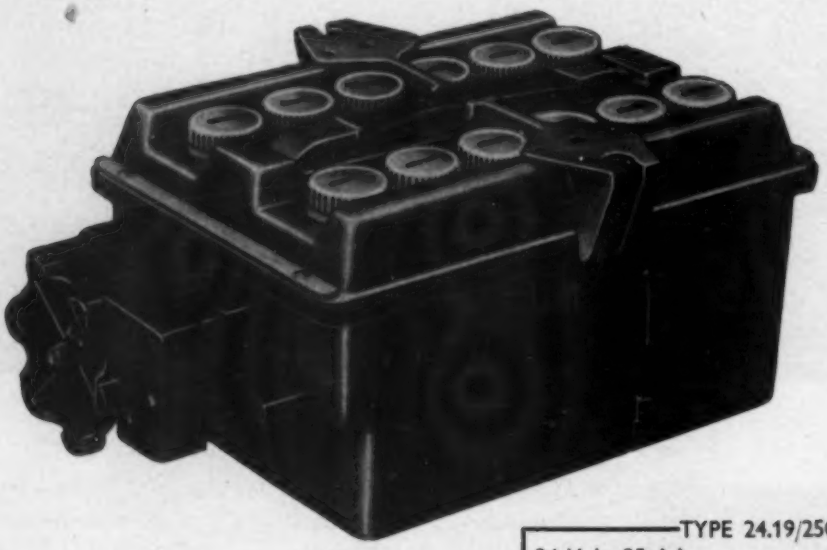

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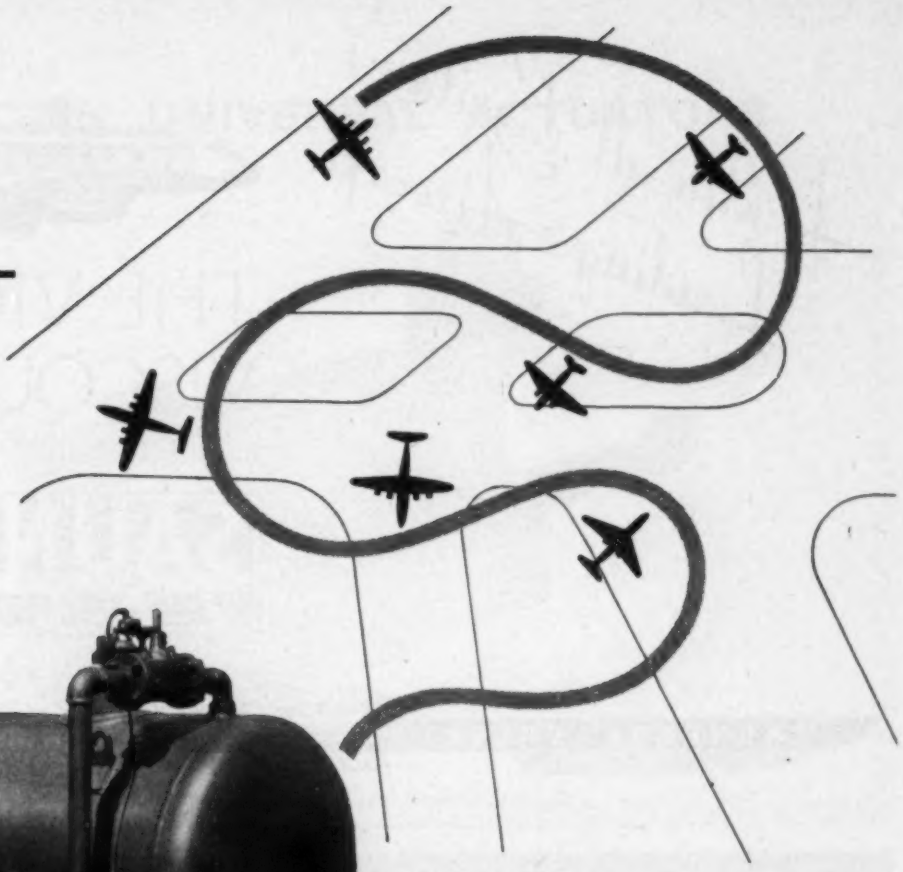

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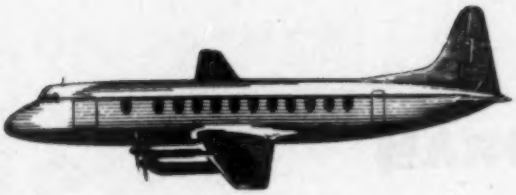

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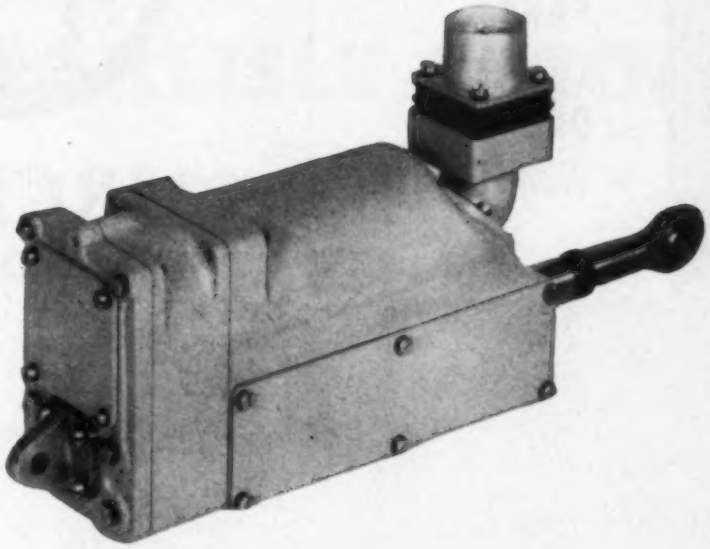

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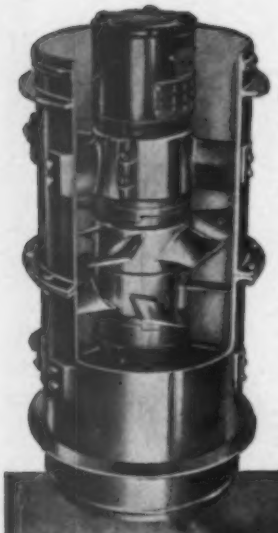

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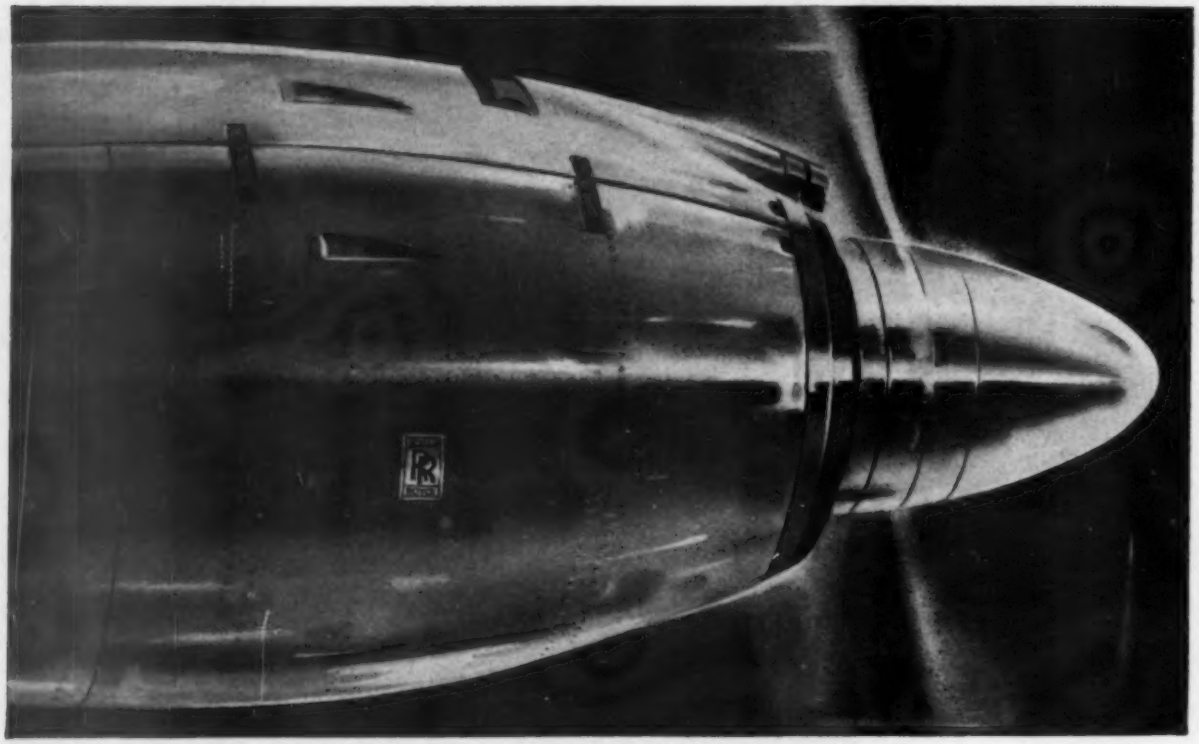

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FLIGHT
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AIRCRAFT ENGINEER

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Vital Factor . . .

BY recent utterances the Defence Minister and the Under-Secretary of State for Air have sought to exorcise the bogy of "no more manned military aircraft"; and it is worth considering how that monstrous apparition ever came to rear its head. The spectre arose, of course, from the Defence White Paper of 1957, and for a full year now it has stalked through the land, implanting the kiss of death on the aircraft industry—or so we are exhorted to believe by proclaimants of occult authority. We ourselves have always harboured the notion that this awful spook was simply the White Paper itself, alarmingly distorted by a draught of rumour here, a tremor of fright there, and a ripple of malice playing all around.

Public perturbation was allayed in some degree by the Defence Minister's recent television interview after his presentation of the 1958 White Paper, on which occasion he emphasized the importance of the manned bomber and pointed out that the U.S.A. and Russia were continuing to build new strategic aircraft of this class. And there was reassurance in these words of the Under-Secretary of State for Air: "After publication of last year's Defence White Paper there was a good deal of talk—mainly among those who hadn't read the White Paper properly—about the day of the manned military aircraft being at an end . . . It is worthwhile pointing out once again that it really is nonsense." He went on to say that manned aircraft would be needed for "transport, cold war support and reconnaissance." And even in fields where missiles were being introduced, manned aircraft would, he said, continue for years and years to offer advantages which missiles could not rival. Above all, they were not slaves of their environment. They had the supreme advantage of carrying a human brain, which for agility, versatility, serviceability and resistance to jamming, knocked any electronic gadget into a cocked hat . . . Virtues like these were not lightly to be set aside, even though we were eager to get on with guided missiles; and the U.S. of S. proclaimed with the utmost deliberation that the manned aircraft was "still a vital factor in every aspect of air power."

. . . or Vitiated Hope?

The (quite literally) unmanning apparition having received such a palpable and authoritative kick in its rear cover, the country awaited the coming of the Air Estimates in the hope that new enlightenment would be admitted to the murky thinking that enshrouded it. First there was the hope that the Air Minister might enlarge upon the Defence Minister's declaration (reported last week) that the low-level tactical bomber being developed for the Royal Navy—the Blackburn NA.39—was being considered for adoption by the Royal Air Force also. It was not unreasonable to hope, moreover, for some reference to the supposed R.A.F. requirement, or predisposition, for an even more sophisticated supersonic low-level attack aircraft. And with Operation Quickstep (pages 264-5) in mind, there was the prospect of more Britannias for the airlift of the Central Reserve—even, perhaps, some official hint of interest in the Blackburn B.107 or Short PD.18 (advanced developments respectively of the Beverley and Britannia).

What was, in fact, forthcoming? No vestige of reference to the NA.39, nor to any future fighter or bomber other than the P.1 and the Mark 2 V-bombers. As for Transport Command, there was scant comfort in the assurance that "Hastings will supplement the Beverley for the moving of heavy freight for intra-theatre transport tasks" (especially as the C-in-C. Transport Command has disclosed that the R.A.F. Hastings strength stands—after some ten years' service—at 30 aircraft).

While it is recognized that a White Paper, presented to Parliament by the Secretary of State for Air by command of Her Majesty, must maintain a rigorous adherence to fact, the hope had been raised that the document for 1958 might be suffused by more sanguine sentiments for the future of the manned air force. Alas, this was not to be; and a spectre remains unquiet.

FROM ALL QUARTERS

Missile Agreement

THE long-awaited agreement between the United States and the United Kingdom on the supply of intermediate-range missiles was published last Monday—concurrently with a Parliamentary statement by the Minister of Defence, Mr. Duncan Sandys—as a White Paper (H.M.S.O., price 4d) containing an exchange of notes between the two governments and a memorandum. The latter states that ownership of the missiles shall pass to the U.K. Government as soon as it is in a position to man and operate them; that training and test-firings "will normally take place on U.S. instrumented ranges," though some missiles may be test-fired at Woomera; that the operational launching of U.K.-based missiles will be a matter for joint decision by the two governments; and that references to missiles in the agreement "do not include the nuclear warheads for them." The U.S. Government is to provide these, but they will remain in full U.S. ownership. The memorandum also states that the British Government is to provide "the sites and supporting facilities" for the deployment of the missiles.

In his statement, and in answer to questions, the Minister said that the missiles would be assigned to R.A.F. Bomber Command, whose plans were being co-ordinated with those of U.S.A.F. Strategic Air Command. Launching sites would be on active or disused airfields "mainly in East Anglia, Yorkshire and Lincolnshire"; and on the operational effectiveness of the missiles, he commented: "I would only say that the Thor weapon is in its final stages of development, and that unless we were confident that it would work we would not have made this agreement."

The Air Estimates

IN his *Memorandum Accompanying the Air Estimates 1958-59* (H.M. Stationery Office, 1s) the Secretary of State for Air, Mr. George Ward, gives their total as £467,050,000 (or £474,550,000 before deducting the Deutschmark costs of 2nd T.A.F. in Germany). The net total for 1957-58 was £487,650,000. This year's estimates include about £11m for improvements in R.A.F. pay, allowances and conditions; but the gross provision for aircraft and equipment is £17,300,000 less than last year's. In the Air Minister's words, "We shall be spending substantially less on airframes, aero engines and vehicles but more on weapons."

Referring to manpower, the memorandum says that R.A.F. strength on April 1 this year will be 193,000 compared with 228,000 on the same date in 1957; and by April 1 next year should be down to 174,000.

On deterrent power, megaton weapons and build-up of the Victor and Vulcan force have greatly increased this; the force's continued effectiveness will be assured by the Mk 2 Victors and Vulcans. A British ballistic missile is being developed on the highest priority; and successful in-flight refuelling trials with the Valiants will now be followed by Vulcan and Victor in the receiver rôle.

WESTLAND WESSEX engine bay and its Napier Gazelle interests the Earl of Selkirk, First Lord of the Admiralty, during a recent visit to Yeovil. With him are Mr. E. C. Wheeldon, Westland managing director (right) and Lt. W. H. Sear, chief test pilot. The Wessex is to replace the Whirlwind in anti-submarine service.

FILM PIONEER: The STOL capabilities of this Scottish Aviation Pioneer should prove valuable in French Equatorial Africa, where it is being used in the Twentieth-Century-Fox film "Roots of Heaven." It is seen about to leave Croydon in the hands of Capt. John Crewdson, managing director of Film Aviation Services.

On air defence, the memorandum says that the P.1 and its associated weapon are being developed to play its part in the smaller fighter force needed to deal with manned aircraft, to prevent reconnaissance and to counter the stand-off bomber and jammer. Firing trials of Bloodhound are proceeding well at Woomera and trials of a complete weapons system should start soon at North Coates, with an operational deployment following. There are also to be Thunderbird trials this year. The streamlining of the control and reporting system has made good progress. "With the introduction of new equipment and better techniques, we can expect Fighter Command to meet a bomber attack at a greater distance from our shores and with a greater proportion of our fighter force both by day and night."

Canberras in 2nd T.A.F. and in Bomber Command are being given a nuclear capacity; in the Middle East, the Headquarters, British Forces, Arabian Peninsula, is to be a separate Command, responsible to London, from April 1, and at the same date A.H.Q. Levant will be abolished and its tasks taken over by H.Q., M.E.A.F. "Both in the Far East and in the Middle East," states the memorandum, "our garrison squadrons can be rapidly reinforced by aircraft of Bomber Command, which are being regularly practised in operating from overseas bases."

The Air Minister mentions that 20 Britannias are now on order "to increase the available strategic airlift," and in a reference to training says that the R.A.F.'s fatal accident rate was virtually the same as in 1956—itself the lowest rate for over 20 years. The use of synthetic trainers is increasing and they are being developed for training for surface-to-air guided weapons as well as for aircraft. Guided weapon training in the R.A.F. is expanding.

Sir Charles Longcroft

WITH regret we record that A. V-M. Sir Charles A. H. Longcroft, K.C.B., C.M.G., D.S.O., A.F.C., died at his London home on February 20 at the age of 74. In the course of a distinguished aviation career he had been one of the original R.F.C. pilots to fly in the 1914-18 War, and in 1920 became first commandant of the R.A.F. College at Cranwell.

Sir Charles Longcroft.

A. V-M. Longcroft learned to fly as an Army officer in 1912 and in July that year, after being attached to the Air Battalion of the Royal Engineers, was commissioned in the R.F.C. One of his first squadrons was No. 2, equipped with B.E.2s, and when early in 1913 it changed station by air he performed the then notable feat of flying from Farnborough to Montrose—a journey of some 400 miles, which he later bettered by flying in the reverse direction non-stop in a B.E. with a 70-h.p. Renault engine and extra petrol tanks.

During the First World War Longcroft made several notable reconnaissance flights, commanding No. 4 Sqn. and later No. 2 (Corps) Wing, which controlled six squadrons. He was decorated by both the Russians and the French and in 1918 was awarded the D.S.O.

After four years in command at Cranwell he became Director of Personal Services at Air Ministry and was promoted to air vice-marshal. He retired from the R.A.F. in 1929 and one of his subsequent appointments (1934-35) was as president of the Aerodrome Board.

***V-FORCE:** Equipped to carry megaton-yield bombs, the British V-force provides, in the words of the recent Defence White Paper, "a mobile and flexible form of military power." This is the first photograph to show all three types of V-bomber together: Avro Vulcan B.1 (Bristol Olympus engines); Handley Page Victor B.1 (A.S. Sapphires), farthest from the camera; and Vickers-Armstrongs Valiant B.K.1 (R-R. Avons).*

Capital Commuter

AN English Electric Canberra T.4 flew from Washington, D.C., to Caracas in Venezuela—a distance of 2,058 miles—in 4 hr 11 min last Saturday. Its flight time is being submitted to the F.A.I. by the Royal Aero Club as an official point-to-point air record between the two capitals. The aircraft, on the last stage of a delivery flight to the Venezuelan Air Force, was captained by Mr. John Hackett with Mr. Peter Moneypenny as navigator; aboard with them was Lt. Leba of the Venezuelan Air Force.

Mixed-Power P.1B

LAST week D. Napier and Son, Ltd., officially stated that the Double Scorpion H.T.P./kerosine rocket motor will be fitted to production English Electric P.1B all-weather intercepters. The actual installation will be identical with that made on the Canberra B.2 (holder of the world's official altitude record of 70,310ft), and it will be faired into a streamlined nacelle housing the peroxide. The overall geometry was shown in our exclusive cutaway drawing of the P.1B (issue of January 10). The complete streamlined tank and motor forms a quickly detachable pack which can, in emergency, be jettisoned.

North American B-70

CONTRARY to an earlier report, it is now known that the U.S. Air Force designation for the aircraft part of the WS-110A weapon system will be B-70. According to the American *Aviation Daily* the prototype B-70 will have six engines, each rated at 30,000 lb "with afterburners in continuous use." "Current plans," continues the publication, "call for arming the B-70 ultimately with both air-to-ground and ballistic type missiles," the latter being carried internally.

One Million Pounds Thrust

IT was disclosed on February 18 that the U.S. Air Force "is working on" a single-chamber rocket motor rated at 1,000,000 lb thrust. Four years ago studies began on a multi-chamber unit rated at 1,500,000 lb thrust. No contractor was mentioned in connection with either programme, and it was disclosed by Richard E. Horner, assistant Secretary of the Air Force, that these large motors were being perfected, not to meet immediate applications, but because they were logical developments.

Irvin Improvement

AN instructive comparison between the performances of old and new types of Irvin parachute was made at Luton Airport last week by Mr. P. K. Rayner.

Using the well-known I.28 canopy that has been the standard equipment of British paratroopers for many years past, he made a jump from an Auster at about 3,000ft, delaying the opening of his parachute in order to reach a higher speed of descent. Conditions were poor, with a surface wind gusting between 10 and 22 kt.

He then made an identical drop with the new I.32 canopy. The reduced opening shock, slower descent, improved stability and control and gentler touch-down were all apparent to the spectators watching from the ground.

Apart from the increase in diameter—32ft as against 28ft—the principal difference in the new canopy is the employment of two fabrics of differing porosity.

The Auster used for the demonstration was flown by Capt. Edwin Sessions of Luton Airways.

R.A.E. Technical College Prizegiving

AN impressive record of degree and national-certificate successes was detailed by Mr. R. D. Peggs, O.B.E., M.A., principal of the Royal Aircraft Establishment Technical College, Farnborough, in his 1956-7 report at the College's annual prize distribution on Friday last, February 21. The year under review, he said, had been characterized by careful and solid consolidation of existing courses rather than any spectacular highlights.

Among the academic achievements were four B.Sc.(Eng.) degrees, 80 H.N.Cs, 68 endorsements to existing H.N.Cs, 67 O.N.Cs, 70 O.N.C. endorsements, and 66 final City and Guilds certificates. Two new prizes for electronics had been awarded by the Mullard company.

Other speakers at the prizegiving ceremony included Dr. G. W. H. Gardner, Director, R.A.E.; Sir William S. Farren, chairman of the College Advisory Board; Sir Alexander Fleck, chairman of Imperial Chemical Industries, who presented the awards; and L. D. Hooper, president of the Students' Union.

Among the many awards presented were the Grinsted Prize for the best student of the year and the A. A. Hall Prize for aeronautical engineering (student apprentices) to J. A. B. Wills; the Perring Prize for student apprentices (A) to C. F. M. Glanister; the Farren Prize for craft apprentices to D. J. Pegg; the Director's Prize for drawing-office apprentices to R. P. Brann; the Hilda Lyon Prize for scientific assistants to Miss E. M. Turner; the Principal's Prize for outstanding leadership to R. C. S. Onslow; and the Sydney Smith Prize for aeronautical engineering (craft apprentices) to E. E. A. Dance.

***COMPARACHUTING:** (Below, right) Mr. P. K. Rayner demonstrates the new Irvin 1.32 parachute at Luton Airport after a similar jump with the older 1.28 type (see "Irvin Improvement," col. 1).*

***SERGEANT** is the solid-propellant successor to the U.S. Army's Corporal tactical ballistic guided weapons. Thirty feet long, it is fired (not necessarily vertically) from a hydraulically elevated launcher. After basic development by Caltech and the A.B.M.A., Sergeant is now in production at Sperry's Utah Engineering Laboratory.*

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QUICKSTEP

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ILLUSTRATED WITH "FLIGHT" PHOTOGRAPHS

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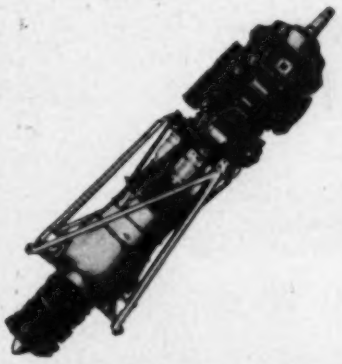

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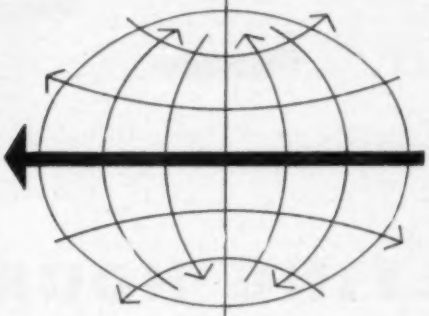

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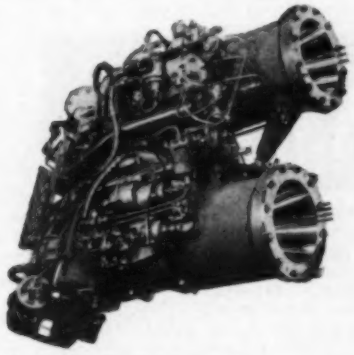

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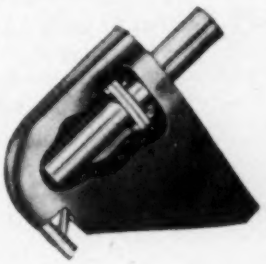

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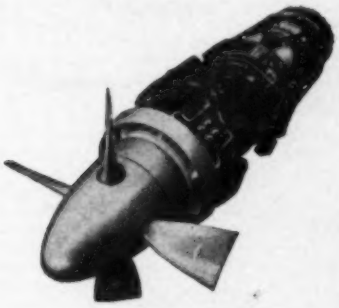

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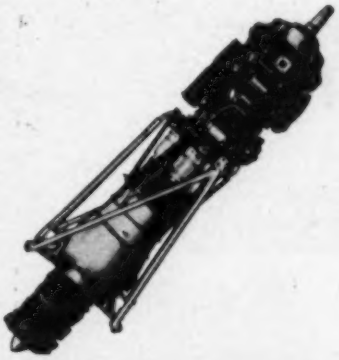

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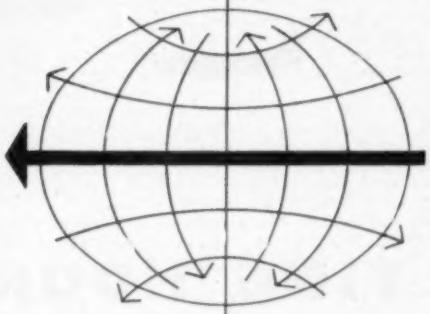

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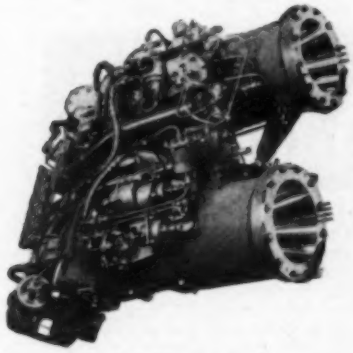

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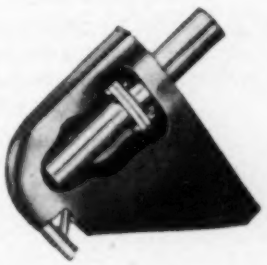

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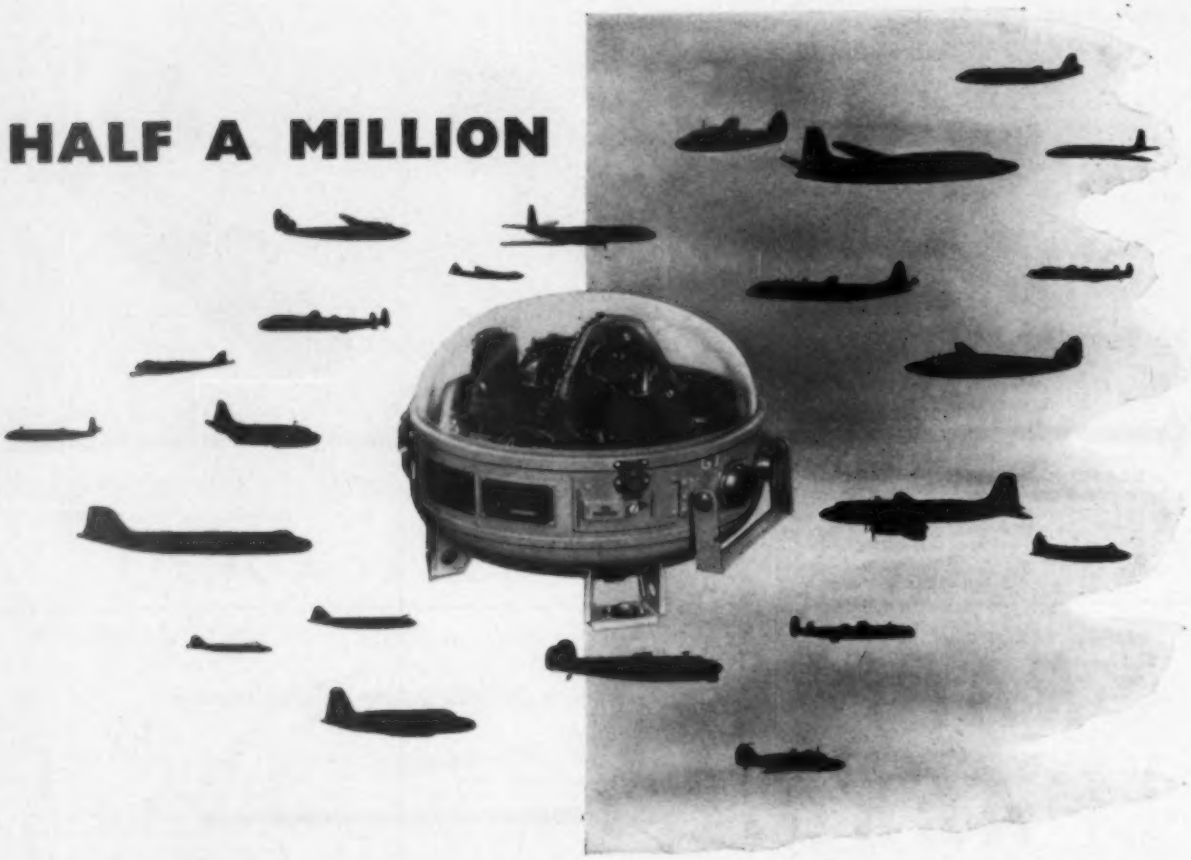

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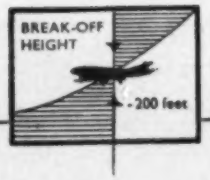
SMITHS

S.E.P.2 AUTOPILOT



IN SERVICE AND ON ORDER FOR 19 OPERATORS

SMITHS AIRCRAFT INSTRUMENTS LIMITED

The Aviation Division of S. Smith & Sons (England) Limited, Cricklewood, London, N.W.2 TGA SM44R

QUICKSTEP . . .

and the local ghiblie wind. Prior to the exercise it had been used by the Flight for flying training and as a pick-up strip for use by Tripolitania District (Tripdist) headquarters at Azizia.

Present strength of the Flight is approximately 56 officers and men. In the past—up to the formation of the Army Air Corps on September 1 last—all pilots have been artillery officers, but the first infantry-officer pilot to join No. 8 Flight was expected later that week. The process of changing from R.A.F. to R.E.M.E. aircraft ground crews is a gradual one, and ground servicing at present is very much a joint operation.

My visit to the Army Air Corps was completed with a rear-seat flight in an Auster 6 flown by Capt. M. J. Page, who already that morning had flown a 2½-hour sortie escorting an "armoured column" (which looked suspiciously like one Land Rover) to Homs, some 100 miles away. While the sturdy infantrymen of the King's Own Royal Regiment and the York and Lancaster Regiment were dealing with guerilla raids on uranium convoys, the kidnapping of a temperamental opera singer and other serious matters, we were to fly to a certain area ahead of "our" troops and look for the enemy.

We found no enemy. From a height of 500ft (climbing to 1,000ft over the search area), however, we obtained an excellent detailed view of the Tripolitanian countryside; and a clear idea of the value of the airborne element in internal-security operations of this nature. A number of Army vehicles were buzzing along the roads; obviously the fight was still going strong, although the local camels looked very bored indeed.

During our flight the wind had veered and strengthened, and the approach at Gurji was over a line of high trees to a landing

Ground crews camouflage one of the Austers (with Tripdist badge on the cowling) after taxying in during the exercise.

across the strip. After several attempts we decided that our war was not as urgent as all that, and diverted to Idris. The Army was at that time interrupting its war to throw a Press luncheon party at an officers' club near Headquarters—which was unfortunate, since we were 20 miles away at Idris, but at least I was on the spot to visit Transport Command.

The first task of the exercise had been the move itself. At Idris, a small transport-support staff headed by G/C. T. N. Stack was responsible for ensuring that the Libyan end of the airlift ran smoothly, and it was in this group's mobile operations centre that W/C. R. J. Dempsey, G/C. Stack's deputy, described its work for me. The operations centre was located in the station education block and, with the temperature outside in the 80s, boasted a large log fire.

Most of the staff of the transport support group were from Transport Command headquarters at Upavon, and their work was divided into the three spheres of operations, movements, and servicing. Planning, briefing and movements specialists are among the officers permanently attached to the group: other specialists co-opted for this operation were extra movements officers (to enable shift working) and a technical officer.

The group had arrived at Idris one day ahead of the troops, and were established in three places on the station. Overall planning and control was exercised from the mobile operations centre already mentioned; the mobile servicing flight was located in a hangar near the aircraft dispersal; and the mobile air movements section rejoiced, and perspired, in an Auster packing case on the edge of the apron.

In the operations room the current and planned activity was displayed on two boards, one a normal operations table and the other a turnround-times diagram. Planned payload for the Beverley on the 1,500-mile flight was 13,500 lb and 47 passengers; the Hastings carried 10,000 lb or 37-40 passengers; and the Comet 37-40 passengers. Beverley payloads on the first outward flight, however, were reduced because of extra fuel necessary to cover possible diversion to Benina. For the return journeys after completion of the exercise, where it was not essential to complete the flight in only one stage, an increased payload would be carried and a refuelling stop at Ystres or Luqua would be accepted if necessary. The entire outward troop-movement had taken 21 sorties, while the return flights would total 18.

An Auster 6 of No. 8 Independent Recce Flight takes off from the sand airstrip at Gurji on a support sortie.

Only snags experienced during the outward flights had been a return to base by one Beverley following radio failure over France; and a two-hour delay in the arrival of another Beverley which had landed with technical trouble at Ystres on its second trip. Some of the turnrounds at Idris, which averaged 2½ hours, had been slowed down by a failure of a Shell bulk fuel-installation pump. Headwinds during the previous night had caused the Abingdon-bound Beverleys to plan 11½ hr for the return flight.

From their packing-case headquarters, the men of the mobile air movements section were handling the problems of load and trim calculations, passenger and load manifests, passenger briefings and the supervision of the unloading and loading of equipment. Most of the actual unloading of the Army equipment had been carried out by the troops themselves, supervised by movements specialists.

One other R.A.F. unit—No. 215 Squadron, which operates Pioneers from Dishforth—was represented, if not directly involved, in Exercise Quickstep. Its commanding officer, S/L. G. F. Turner, and another of the squadron officers were acting as staff air advisers to Brig. Frisby at his Azizia headquarters during the operation.

Unique in being the only R.A.F. squadron permanently attached to the Army, 215 does in fact normally work with the 24th Infantry Brigade, whose headquarters are at Barnard Castle, Durham. Although on this particular exercise use was made of the local Army Air Corps Flight, 215's Pioneers would if necessary be dismantled, loaded into Beverleys and transported overseas to work with the troops in a similar manner.

This, then, was Exercise Quickstep, completed as scheduled by Friday of last week. The Army and the R.A.F. had gained experience of the snags which could arise in this sort of operation. Certain British newspapers had concluded that the concept of a mobile strategic reserve was a myth. Another had extrapolated at length from Quickstep to Middle-East politics, and its sale had been banned in Tripoli. Britain had honoured her Treaty obligations to Oleandia, and all was well. K. T. O.

Looking down on the airstrip, which is used also as a sports ground, from one of the Army Air Corps Austers.

***RETRACTABLE SKIS** have been designed by Auster and fitted to this AOP.6. The skis are all-metal and have a Bakelite under-skin to stop freezing and cut down snow drag.*

HERE AND THERE

Viper to Farandole

THE turbojet derived by Marcel Dassault from the Armstrong Siddeley Viper and formerly known as the R.7 is now called the Farandole, and is specified for the Dassault Méditerranée light executive transport (*Flight*, February 14, page 195). Thrust is quoted as 3,000 lb.

Captains in the Making

ON Saturday, March 8, in its "I want to be . . ." series, the B.B.C. is dealing with the training and work of an airline pilot. Made with the co-operation of B.O.A.C., the feature will include recordings made at London Airport and on the flight deck of a Britannia 102 between London, Khartoum and Aden.

More T.11s for Sweden

A CONTRACT has been signed by the Royal Swedish Air Board for 12 Vampire T.11 fuselages to be manufactured by the de Havilland Chester factory and completed as aircraft in Sweden. Sweden ordered her first Vampires in January 1946; since then a large number of Vampires and Venoms have been delivered to the Royal Swedish Air Force, and Ghosts and Goblins have been manufactured under licence by Svenska Flygmotor.

Heinkel Aero-engines

FOLLOWING its licence agreement with the Dundalk Engineering Co., under which machinery is to be transferred to this Irish concern, the Heinkel company in Stuttgart is to cease making "bubble cars" and devote the increased factory space available to the production, repair and maintenance of aircraft engines. Heinkel will continue to make scooters.

Helicopter Talk

AN illustrated talk on *Helicopters and their Uses in Africa* is to be given by Mr. Leonard Thornhill (of Westland Aircraft sales department) to the London Society of Air Britain at Caxton Hall, London, S.W.1, at 7 p.m. on March 5. Visitors are welcomed.

Cushioned Recovery

SHOWN in the accompanying photograph is the recovery system which, as mentioned in our "Missiles" number of December 6, has been developed by the Martin Company for test or training firings of the TM-76 Mace. The system, which is fitted in place of the warhead, consists of three 100ft parachutes and two neoprene-coated nylon fabric air cushions, the latter made by the Goodyear Tire and Rubber Co. Recovery procedure begins with the throttling back of the missile's turbojet to 60 per cent power and the ejection of a drag chute. At 2,500ft the main parachutes are deployed and nearer the ground the air cushions are inflated. On contact, release valves allow a partial escape of air in order to reduce shock loads and to minimize the risk of the cushions bursting. The cushions, which are highly stressed and heat resistant, are re-usable. This principle of recovery was pioneered by de Havilland Engines, for rocket motors.

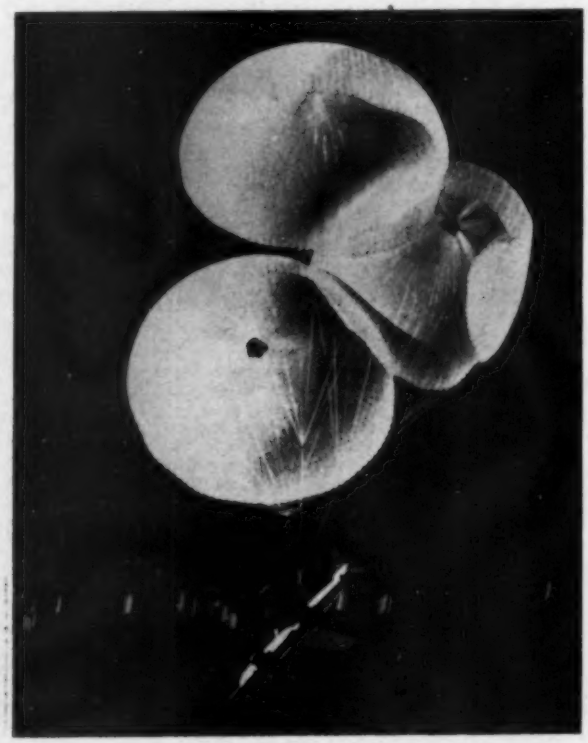
Good Reading

READERS interested in the respective fields covered by two of *Flight's* associated journals may like to be reminded of special numbers shortly to appear: next Wednesday, March 5, *Amateur Photographer* is publishing its annual Outdoor Number; and on the following day *The Motor Cycle* Spring Number and Buyers' Guide will be on sale.

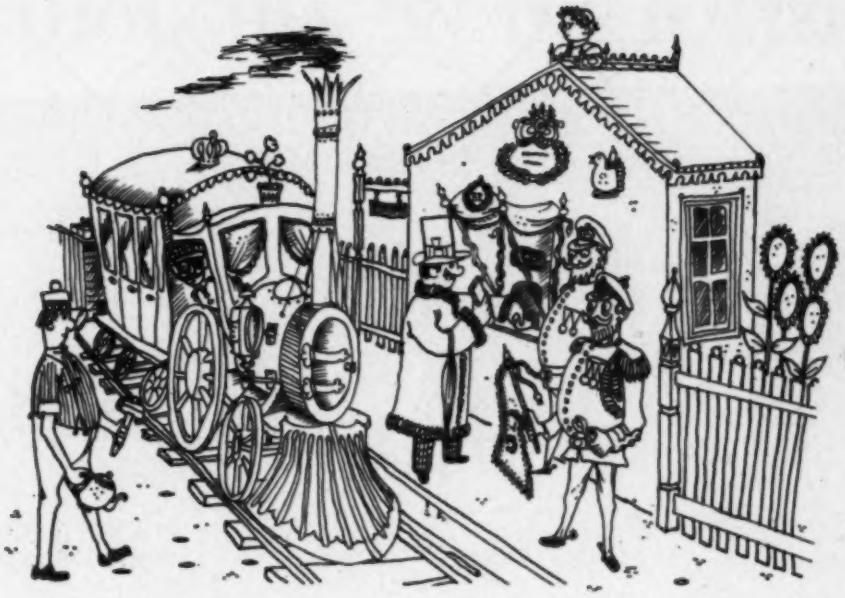
Chelsea College Film

ACTIVITIES of students training at the Chelsea College of Aeronautical and Automobile Engineering form the subject of a ten-minute documentary film intended for exhibition throughout the world and recently shown to the Press in London. With the title *Chelsea College*, the film traces the progress of students in each of the College's three main departments—aircraft, automobile and agricultural engineering. At the present time, there are 401 students at the College, of whom 173 are from foreign countries, 137 from the Commonwealth, and 91 from the United Kingdom. Principal of the College is Mr. J. A. C. Williams, M.Sc., A.F.R.Ae.S.

***LETTING DOWN:** A Matador descends (right) with the aid of the cushioned-recovery system described in a news-item above.*



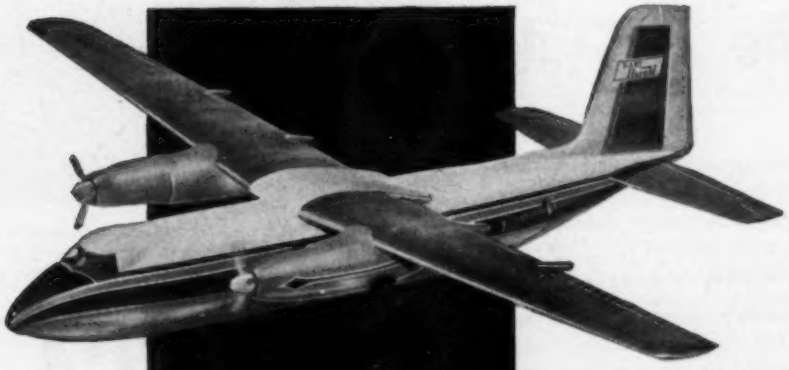
***SITTING UP:** S/L. E. G. Franklin, A.W.A. chief test pilot, is seen below after clearing one of the 68 Sea Hawks now being delivered to the German Navy. Technicians from the Focke-Wulf factory at Bremen (where the aircraft will be maintained) are at present undergoing courses at the A.W.A. works; pilots are to convert at Lossiemouth.*



There's Big Money in Branchlines . . .

. . . but you must have the right aircraft for the job. The turboprop-powered Dart Herald is ideal; it cruises at 275 m.p.h. and carries 43 passengers or nearly 5 tons of freight—or combinations of both. Its range is 1,400 miles with a 6,200 lb. payload.

Cheap to operate, easy to maintain, comfortable to travel in, the pressurised Dart Herald—with its renowned Rolls-Royce engines—is made-to-measure for short- and medium-range air routes anywhere in the world.



DART *Herald*

ENGINES: TWO ROLLS-ROYCE DART PROP-JETS

HANDLEY PAGE

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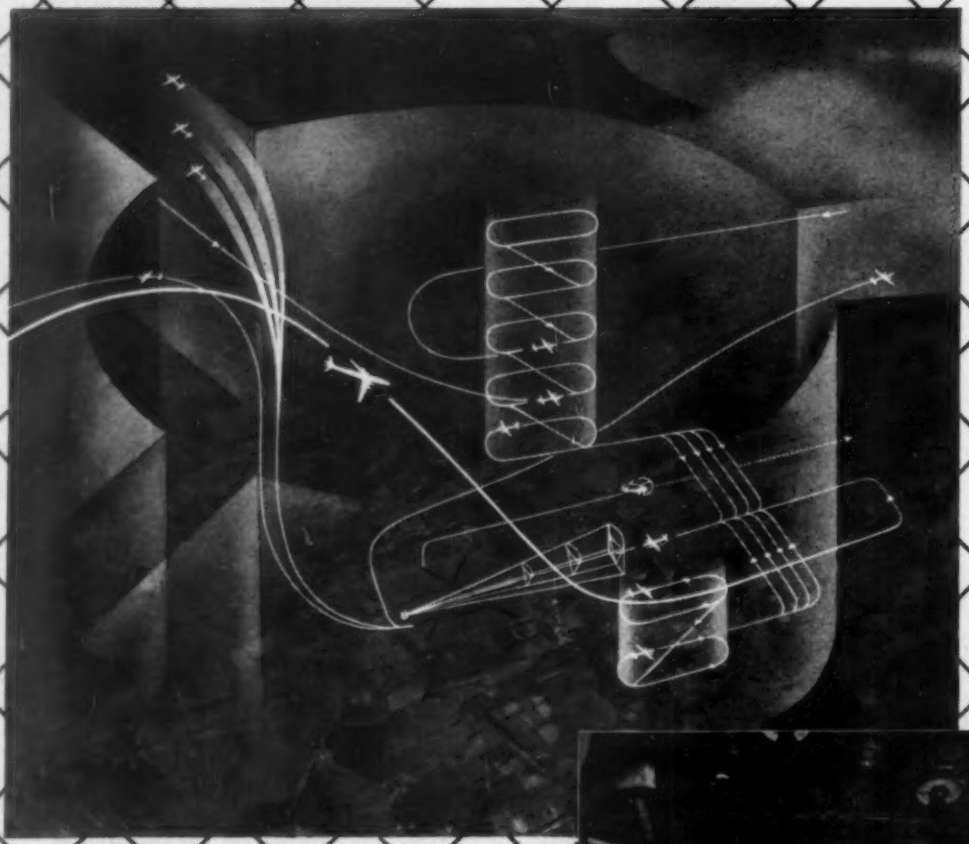

All BEA Viscounts are fitted with the Decca Navigator. Invaluable information on the requirements of jet age air traffic has been gained from over four years' operation in these aircraft.

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THOUGHTS ON THE D.H.121

The Evolution of a New Kind of Airliner

THE political and industrial wrangling which followed B.E.A.'s selection of the D.H.121 has been discussed to the point of tedium. But now that B.E.A. are free to negotiate for the aeroplane of their choice, it is refreshing to look for a change at the aeroplane itself as a particularly interesting exercise in aircraft design.

The D.H.121 represents a new class of airliner. Short-range air transport has not previously yielded to economic exploitation by jet propulsion, and a jet airliner designed for such work is an exacting design-exercise that falls into a distinctive—some would say specialized—class of its own.

B.E.A. have avoided using the word "specialized," in the sense that it suggests a limited export market. But a jet airliner designed to make a profit over short-haul networks, which are traditionally air transport's most unrewarding (from a financial viewpoint), *must* be specialized in the technical sense. Indeed, its market would be limited if it were otherwise—if, for example, it strove from the start to fulfil also the medium-haul requirement. Admittedly any advanced jet transport designed to meet the B.E.A. specification must tend to invade the medium-haul category to some extent; but this tendency is resultant rather than causative.

The immediate past history of the D.H.121 goes back to the D.H.118. This project was conceived in the autumn of 1956, and was a short-lived, politically influenced attempt to fulfil B.O.A.C.'s medium/long-haul requirement. Already, in July 1956, B.E.A. had made known to the industry their own outline requirements for an optimum short-haul jet. A project numbered D.H.119, powered by four late-model Rolls-Royce Avon RA.29s, appeared in the last weeks of 1956, with B.E.A.'s requirements particularly in mind. But early in 1957, some months before the other Corporation's requirement was finally satisfied by the much larger Vickers VC.10, an attempt was made to arrive at a basic design to satisfy the requirements of both Corporations. This was the D.H.120 project, for which four Rolls-Royce Avon RA.29s or RB.140s (scaled-down Conways) were considered. These were installed, as in the 119, behind the rear wing-spars, with their intakes below the wing. As de Havilland had expected, this project, like the 119, satisfied neither Corporation. It was too big for B.E.A., and B.O.A.C. were favouring the VC.10, and the long-haul potentialities which its uncompromised design offered. So D.H. concentrated on B.E.A.'s requirements; and thus it was that, a little less than a year ago—in May 1957—the D.H.121 was born.

B.E.A.'s Requirements

It is now generally known that B.E.A.'s basic requirements specified a 600 m.p.h. jet transport to carry about 70 first-class passengers over stages of 1,000 n.m., with a take-off field-length of 6,000ft. B.E.A.'s feelings on these points were not inflexible. Their specification constituted a basis for discussion, so that there could follow a period for the cross-fertilization of ideas, in which the ability of the contending design teams could be tested.

The first problem the designers had to tackle was the choice and number of engines. Fortunately for de Havilland there was little restriction in choice: Rolls-Royce, with whom they worked from the start, announced their willingness to build an engine of whatever size was needed—so great has their experience now become. Thus the eventual selection of the triple-RB.141 formula was not dictated by the non-availability of a smaller engine suitable for a four-engine layout.

The choice of the three-engined scheme was clearly the result of reasoning which ran along the following lines. The fewer the engines, the less the capital and maintenance costs—factors vital to the economics of the aeroplane—and the lower the total installed weight. But why not *two* engines? Here the power-failure performance requirement would have called for engines so large and powerful that the economies of two engines would have been outweighed by their very size and expense. The aggregate thrust of two engines would obviously have to be considerably more than the 36,000 lb of three RB.141s. The latter is a by-pass engine with a higher by-pass ratio than the present Conway.

There were many other pro-three-engine considerations, among them the two-engine failure case (admittedly remote), and also the existence of a ready-made insurance engine in the RA.29. All these things tended to favour the contention that a right number of engines for a short-range jet is, in the words of a B.E.A. engineer, "less than four, but more than two."

Next came the biggest problem—the method of installation. A wing-mounted arrangement was not possible: an underslung middle engine would have been a short-lived inhaler of runway-debris. Soon the choice narrowed to engines in, or on, the rear fuselage, particularly as this made possible a cleaner wing and a quieter cabin.

Nevertheless, the positioning of the middle engine must have been a classic exercise in "optimizing" the factors of weight, intake-efficiency, tailpipe-losses, cooling, accessibility, and ease of engine-changing. Several schemes were no doubt assessed before the final one was chosen. It was obviously important that the centre engine should not be buried within the fuselage and the fin structure, and the artist's impression (page 268) shows that this has been avoided. Cooling probably presented no great difficulty, and in any case the by-pass engine is not critical in this respect. Accessibility was not awkward, since the engine and its accessories could be readily exposed by unstressed cowlings. The engine-removal aspect was perhaps less favourable, though the "up, out and down" slinging technique would present no particular difficulties.

The resulting compact engine arrangement appears to have left plenty of space in the unpressurized rear fuselage for a well-planned grouping of engine-supplied power-system equipment, such as the main units of the electric, hydraulic and cabin-air systems.

The Airframe

It is clear that the tailplane ended up on top of the fin for four main reasons: maximum static stability by virtue of the greatest possible moment arm; lowest demand on elevator size for landing; maximum clearance from reverse thrust and jet blast; and lowest net weight.

Fuselage size and capacity is probably not yet finally decided. It would seem sensible to adopt an internal diameter sufficient to accommodate an inevitable airline requirement for six-abreast seating—which means an internal diameter of at least 11ft. It is foreseeable that B.E.A. may require more than 70 (probably nearer 80) first-class seats at 38in pitch five-abreast, which would suggest a maximum 34in six-abreast capacity of perhaps 100 or more. Windows would be numerous, to permit the maximum flexibility of seating. The fuselage cross-section would probably have two intersecting radii (almost a double-bubble), to procure in the most structurally economical way, the big freight capacity which B.E.A. need to ameliorate their off-peak passenger problems.

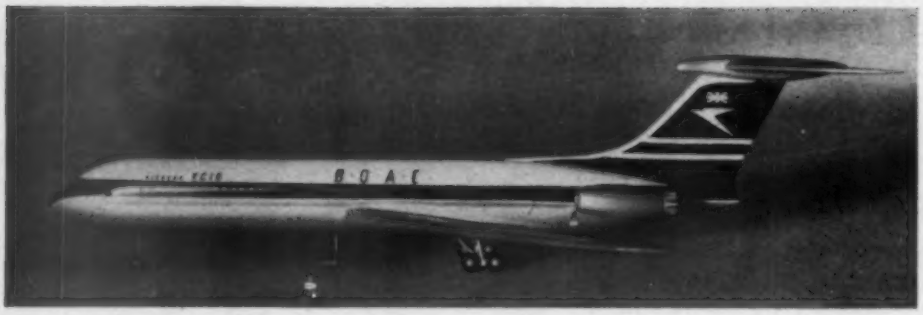
The wing, being completely unobstructed by engines, is generally a designer's dream. An exception is the problem of undercarriage attachment, which for balance reasons tends to be located behind the main wing box. The main gear would be a four-wheel bogie. The possibility of employing high-lift devices which the clean wing affords ensures that there will be no worries about meeting the 6,000ft field-length requirement.

The flying-control surfaces would almost certainly be capable of manual operation. Although Comet practice was full duplicated power-operation, advances in knowledge of high-speed control make manual controls an obvious choice today. Cruising Mach number would probably be of the order of 0.9—600 m.p.h. at 30,000ft.

Future Development

One has to bear in mind that there are six years to go before the 121 is required to enter service (B.E.A. are aiming for early 1964). Many points obviously must still be liable to change from week to week during this early phase. But in general it may be said that it looks as though B.E.A.'s 1,000-mile full-payload stage length, and 6,000ft take-off requirements can be met by an aeroplane weighing nearer 100,000 lb than 120,000 lb, yet which offers a useful built-in stretch in payload/range capability for those customers who want it.

D.H. have set their sights firmly on the short-range export market, and they believe that the B.E.A. specification can produce an aeroplane capable of fulfilling the needs of that market more efficiently than anything designed for medium-haul routes. The latter market is in any case well served by existing designs. But there seems to be no reason why the 121 should not operate at higher weights with extra fuel. The basic airframe appears to have plenty of fuel capacity—at least enough for double the specified stage-length—and with a little undercarriage beefing the basic B.E.A. aeroplane could probably be offered with a higher gross weight to airlines who want the extra range and can accept slight relaxation in the field-length required.



"Flight" photograph

VC.10—the jet transport upon which B.O.A.C. appear to be exclusively planning.

By

J. M. RAMSDEN

The Corporations Swing to Jets

IMPLICATIONS OF B.O.A.C.'s AND B.E.A.'s MASSIVE TURBOJET ORDERS

THERE is not very much doubt that, in the end, B.E.A. will be allowed to have their D.H.121 jet fleet. There are precedents enough for the inviolability of the two Corporations' commercial judgement: one recalls the turbulent scenes behind B.O.A.C.'s DC-7C order, and the angry preliminaries to their subsequent requirements for Boeing 707s. These were issues just as touchy as those aroused by B.E.A.'s jet, because they concerned the international standing of the British aircraft industry.

The B.O.A.C. controversies may have differed from B.E.A.'s, but obeisance has always been made to the sanctity of the principle that the Corporations know their business best.

The result is that the two sister-Corporations can look forward to a future in which they should be the most competitively equipped airlines in the world. None of their rivals is likely to be so well backed both ways with such quantities of jets and turboprops.

This state of affairs must bring great satisfaction to the Corporations, and to those sections of the British aircraft industry which are to supply the new airliners. But it is remarkable that, at a time when public spending is the gravest of all national issues, no questions are asked when B.O.A.C. sign a £60 million order for 35 VC.10s, and conditional approval is given to B.E.A.'s £30 million order for 24 de Havilland D.H.121s.

It is but a few weeks since the Chancellor of the Exchequer resigned—for the sake of his principle that public spending is being inadequately curbed, and that the nation is "attempting to support a range of projects beyond the resources at its command."

There were, of course, Treasury strings attached to B.E.A.'s £30 million order for a new jet fleet; but these were concerned mainly with the aircraft industry and required little compromise from B.E.A. And it is true that the actual building of the D.H.121 and the VC.10 is to be privately financed, thus providing a national export potential which will not cost the taxpayer a penny.

But nevertheless some uneasiness is felt—uneasiness which is difficult to define because issues of national prestige are involved. Such issues are always emotional in character, and they tend to blur the commercial considerations which, in a perfect British air transport system, would be paramount. One can, if one must, accept the requirements for prestige; but there are still some questions which call for examination.

For example, why have both Corporations ordered such a large amount of aircraft capacity, and can they hope to utilize it all profitably? Are the Corporations—and particularly B.E.A.—justified in having swung so decisively towards jets? Would the commercial efficiency of the Corporations bear comparison with that of airlines which have to finance their equipment themselves, and whose livelihood depends upon the correctness of their commercial judgment?

There can be no straight answer to these questions; but to examine them is not to deprecate the fine work the Corporations have done in building up the nation's air transport business to its present eminence. Wherever B.E.A. and B.O.A.C. fly they present a standard of service which is not surpassed.

In that respect the custodians of the public purse can feel that money has been well spent. Therefore the answer to the first question must be that the returns on a public investment of many millions are two flag-carrying Corporations whose standards of equipment and service are as good as any in the world, and whose value as instruments of national prestige and commerce is very high.

But, after 13 years of post-war fleet-construction, there is no sign of a stiffer commercial approach to the financing of equipment. Analogies with America, where the airlines have to buy their new aircraft out of earnings, are intriguing, if academic; the Corporations do not have to conduct their business in a way which will ensure the attraction of capital. If the Corporations want to buy new equipment, the requisite sum, within generous limitations, is available from the Exchequer coffers at low rates of interest ranging from 2½ to 4½ per cent. The cheap availability of money to the Corporations makes striking comparison with the present financing difficulties of the U.S. airlines. One could not help reflecting during the B.E.A. jet controversy that there would never have been any controversy if the Corporations had been able to raise the necessary capital themselves.

Obviously, the Government properly regards public investment in the Corporation as an investment also in the British aircraft industry. But the public, as subscribers of the Corporations' capital, might be justified in wondering about the commercial policies which that capital appears to be sustaining.

A Place for the Turboprop? For example, it might be asked why the two Corporations have ordered such very large amounts of capacity, and whether they can expect to fill it all. *Flight* has previously assessed the capacity of B.O.A.C.'s fleet of 35 VC.10s *versus* the traffic growth required to fill them (issues of June 7 and September 20, 1957). The conclusion, reinforced by the option on a further 20, was that B.O.A.C. are planning to standardize on an all-jet fleet of VC.10s by the mid-sixties.

Those who want to see a place for the turboprop in B.O.A.C.'s future plans can do the sums of traffic-growth *versus* capacity-on-order again and again, but they will be disappointed. The Britannia does not appear to figure in the Corporation's long-term plans. It is questionable whether the Government would have withdrawn its support for the Orion—the engine which was designed to exploit the Britannia to its maximum, and upon which large public sums had been spent—if B.O.A.C. had stuck firmly to their decision to buy 60 for retrospective Britannia installation.

Of course B.O.A.C.'s VC.10 fleet will not be at full strength until the mid-sixties, which gives the long-range Britannia a working life of six or seven years. But should the days of this economical aircraft be so numbered? It lies within B.O.A.C.'s power to establish an enduring place in air transport for the

D.H.121—upon which B.E.A. also appear to be basing their long-term plans.

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All-weather operation. The aircraft can operate by day or night in all weathers and therefore provides front line defence at all times. It has full navigational and landing aids, airborne search and track radar. Automatic flying aids enable the pilot to concentrate on the task of attack.

An integrated weapon system. The airframe, its components, engines, armament, fire control system and other equipment have been developed to work together as a co-ordinated whole so as to achieve the maximum operational performance.

Flexibility. The aircraft has a wide speed and performance range, the measured speed range to date being very much greater than ten to one. Alternative armament and other auxiliaries give it great versatility.

Inherent aerodynamic stability. The aircraft is fully supersonic yet inherently aerodynamically stable and free from pitch-up throughout its speed range without any assistance from electronic aids.

Twin engines for safety and economy. The installation of twin-engines enables complete duplication of all power control systems and the power supply for them. At the same time it gives supersonic performance without re-heat and affords considerable fuel economy under appropriate conditions. The positioning of the engines along the centre-line of the fuselage provides maximum safety, since the aircraft does not develop asymmetric characteristics when flying on one engine.

Development potential. The basic design has great potential for development, not only in performance, but also in adaptation to other roles. This ensures economies in production and operation.

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THE CORPORATIONS SWING TO JETS . . .

long-range turboprop. Not only because there ought to be a return on the nation's very big turboprop investment (£17 millions on the Britannia and its engines), but also because the benefits of lower turboprop costs—which even the most diehard protagonist of the jet must acknowledge—deserve to be applied to the expansion of air travel.

Air transport is no different from other forms of business inasmuch as there is only one main road to prosperity: lower production costs. Lower costs mean lower prices, lower prices mean increased demand, increased demand means the opportunity for organizing production on a larger scale—which permits unit costs to be lowered again.

The rôle of the turboprop seems so clear: yet B.O.A.C. are apparently prepared to let its long-term future go by default. Even the more immediate future is in doubt: there are only 12 months to go before Britannia traffic will be importuned by Comets and 707s. There is no doubt that, for the same fare, the passenger will go by jet.

It is wishful to think that the Britannia will not be on the defensive when the jets begin to challenge its present trunk-route superiority. The Britannia will lose business unless it is marketed in a different way. To pass on the lower costs of the turboprop in the form of lower fares may be unacceptable to I.A.T.A., but how else do B.O.A.C. hope to fill their Britannias?

B.E.A. also seem to be wavering in their turboprop beliefs. A fleet of 24 D.H.121s, with an option on 12, hardly represents the requirements for "a handful of jets to meet competition" which B.E.A. originally proposed.

A fleet of 24 D.H.121s is equal in productivity to a fleet of 30 Vanguards. Why, 12 months after the signing of a contract for 20 Vanguards (the turboprop which resulted from a long study of the requirements for the ideal short-haul airliner) the need for 150 per cent more capacity? Table I shows the estimated productivity of B.E.A.'s fleets in 1965, assuming that all the Corporation's piston equipment, Viscounts and Comet 4Bs will have been disposed of by then—a generous assumption.

TABLE I: B.E.A.'S CAPACITY IN 1965

	No.	Payload (short tons)	Typical block speed (m.p.h.)	Utilization (hr)	Production short-ton miles
D.H.121	24	10	450	2,250	243 million
Vanguard	20	11	320	2,250	159 million
					402 million

Note: Estimated typical figures for each aircraft.

To fill that capacity, assuming a 65 per cent load-factor, B.E.A.'s traffic will have to increase from the 90 million ton-miles carried in 1956-57 to 260 million in 1965-66—an annual average rate of increase of more than 12 per cent. B.E.A. will do well to maintain such a rate of expansion over the next eight years: it may only be achieved by a marked lowering of fares.

It cannot be said that B.E.A. have over-ordered, but the Corporation clearly plan to carry 60 per cent of its traffic with jets by the mid-sixties. And the option on an additional 12 D.H.121s suggests that jets are intended to carry an increasingly higher proportion of B.E.A.'s business. In other words, the Vanguard seems destined to play a secondary rôle in B.E.A.'s affairs.

All this seems to have been overlooked in the political tussle of the last few months. To push the turboprop into the background does not seem to make good sense, unless B.E.A. are

Vanguard, the turboprop with advantages of low cost which B.E.A. also can direct to the expansion and benefit of their business.

Britannia 312, the turboprop which offers B.O.A.C. the opportunity to expand air transport by a lowering of fares.

planning on really vast expansions of traffic during the next few years, and further orders for the Vanguard. But how can such expansions be accomplished without a lowering of fares? And should not the Vanguard be the chosen instrument?

Like B.O.A.C., B.E.A. no longer appear determined to exploit the turboprop—the form of transport which it pioneered—to the utmost. There might well have been a condition attached to the granting of B.E.A.'s jet requirement: an assurance of the Corporation's long-term commercial plans for the turboprop, and of returns on its Vanguard investment.

When asked some months ago in a B.B.C. programme about the prospect of differential fares for the turboprop, B.E.A.'s chief executive, Mr. A. H. Milward, said, in effect: "We are up against big vested jet interests in I.A.T.A." He might have added that B.E.A. have big vested interests in the turboprop.

In fact, the two Corporations have bigger stakes in both forms of transport than any airline in the world. Jointly in I.A.T.A. they could be the spearhead of a differential-fares campaign. There is no disputing the fact that (we quote from Mr. Stephen Wheatcroft, economic adviser to B.E.A.): "Without a fare differential, the jet, particularly on longer routes, has an earning power which without much doubt will put the turboprop out of business. With a differential, however, an assessment of the future would look very different. I am sure there will always be a very large market for the lowest fare level."

The differential-fare issue ought not to be shirked, or put off to see how things turn out. To fail to face this issue now may be to fail, in the long run, the economical British turboprop.

Commercial Efficiency. On the question of commercial efficiency, certain indices of this desirable business asset might now be examined. The Corporations are very attentive to the fact that, by most of the accepted yardsticks, and taking into account their particular operational circumstances, their efficiency-performance falls short of the best airline standards.

The following measures of efficiency might be selected for the purposes of comparison: (1) profit as a percentage of revenues; (2) profit as a percentage of capital invested; (3) output per employee; and (4) cost per ton-mile of output. Any of these measures, taken by itself, can of course be misleading, due to the widely differing operational circumstances beyond the control of particular airline policies. But viewed as a whole, they offer a fair gauge of efficiency, and a comparative analysis between the two Corporations and the American industry—which, it must be remembered, cannot rely upon public loans for its new equipment—is illuminating.

A comparison between B.O.A.C. and PanAm, taken over a period of the last three years, works out roughly as in Table II.

[*Continued overleaf*

TABLE II: MEASURES OF EFFICIENCY—1

	Average Profits		Average Output/ Employee (ton-miles)	Average Cost/Capacity ton-mile (pence)
	% of Revenue	% of Capital		
B.O.A.C.	3.5	2.8	13,900	39
PanAm	4.6	6.6	31,600	32

Notes: (1) Profits are those before deduction of capital interest (B.O.A.C.) and before deduction of dividends (PanAm); (2) Capital includes issued shares, loans and reserves in both cases.

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The differences are quite remarkable, particularly in respect of profit as a percentage of capital, and also in staff-productivity. It must be acknowledged, however, that numerous factors have militated against B.O.A.C.—notably the perennial equipment troubles which have not been of their own making.

A comparison between B.E.A. and an equivalent international short-haul operator is not possible, since none which is quite comparable exists. There is probably no form of air transport quite so difficult to run successfully as short-haul international services in Europe—particularly if no long-haul business is available to balance out the inherently difficult economics of short routes. Thus comparisons between B.E.A. and any particular American airline are invalid (though it must be noted that comparisons between B.E.A. and the European airlines with whom they are associated in the Air Research Bureau show B.E.A. in quite a favourable light).

Nevertheless, the following combined results of the two British Corporations against the combined results of the whole scheduled U.S. airline industry does serve to make the point that, even allowing for the basically more difficult circumstances of the two Corporations, there are big margins of difference in the measures of efficiency specified. Table III again shows results over the past three years.

There are mitigating circumstances which can no doubt be cited to account for the less favourable Corporation results. Nevertheless, there is the counter that the more favourable American figures are obtained by an industry whose domestic revenue rates —i.e., prices to the public—average less than a half those of the Corporations; whose labour and material costs are the highest in the world (for example, captains get the equivalent of up to £7,000 a year), and whose new equipment has to be privately financed.

TABLE III: MEASURES OF EFFICIENCY—2

	Average Profits		Average Output/ Employee (ton-miles)	Average Cost/Capacity ton-mile (pence)
	% of Revenue	% of Capital		
B.O.A.C. } B.E.A. }	3.8	3.1	13,200	40
Total Scheduled American Airlines	4.5	7.6	41,000	25

Notes: (1) Profit and capital figures are estimated on the basis noted beneath the previous table. (2) American figures incorporate results of domestic trunks, local services, international services, helicopter lines, Alaskan lines, all cargo carriers, and "territorial" airlines.

Conclusions. There is no doubt that public investment in B.E.A. and B.O.A.C. has secured for the nation two airlines which are not surpassed in quality of service or equipment The scale of this investment has been such that both Corporations are to be comprehensively backed both ways with turboprops and turbojets, to an extent unparalleled by any other airline. Their future positions in world air transport should be secure. Furthermore, this investment is supporting a highly competitive range of exportable British transport aircraft.

But the very scale of this investment, and the ease with which it has been obtained, prompts two suggestions. First, heavy capital expenditures on new equipment might well be accompanied by improvements in the measures of efficiency. Second, the Corporations should prove, by strongly urging I.A.T.A. to consider differential fares, that they do not mean to abrogate their long-term turboprop plans. Unless they do so, the nation's big investment in the turboprop will not be justified, nor will it be rewarded.

A PIONEER REMEMBERS

FAMED as one of the founders of the Short Bros. business, as a balloon manufacturer and as a pioneer in stressed-skin metal aircraft construction, Mr. Oswald Short, F.R.Ae.S., F.Z.S., F.R.A.S., recently celebrated his 75th birthday.

A few weeks ago M. Jacques Allez, president of the Aero-Club de France, invited him to attend a dinner given in celebration of Henri Farman's one-kilometre flight in a Voisin biplane in January 1908. Mr. Short, however, was at that time recovering from an illness and could not travel to Paris. In a letter expressing his appreciation of the invitation and his regret at being unable to accept, he recalled the time when he had made his first balloon ascent, with his late brother Eustace, in 1898.

"I came to the Paris International Exhibition in 1900," he wrote, "with my late brothers Horace and Eustace, and the late Colonel Gourand, representative of Thomas Alva Edison in England.

"From Eiffel's octagonal room at the top of the Eiffel Tower, Horace used his instrument for magnifying sound from an Edison phonograph. It could be heard four miles away. But to Eustace and myself Paris was, in our minds, sacred ground, because it was to us, as it will always be to everyone, the home of ballooning.

"The French aeronauts M. le Major D'Arlande and M. Pilatre du Rozier made the first conquest of the air on the 22nd of November, 1783, *avec la machine aerostaque chargee suivant les principes de M. de Montgolfier.* But the aeroplane replaced this balloon and great honour is due to Henri Farman, one of the great pioneers of aviation in Europe."

Mr. Short's illness—from which, happily, he is now fully recovered—had also prevented his attending the "Pioneers of Aviation" dinner held by the Royal Aero Club in London, at which the Duke of Edinburgh presided. On that occasion he telegraphed to Col. Preston, R.Ae.C. Secretary-General:—

"My doctor has advised me not to make the journey to attend the dinner this evening. Would you therefore, on my behalf, be kind enough to make my humble duty to our illustrious guest and to all my old friends gathered together on this historic occasion to say how much I regret being unable to be present with you. It seems a long time now since the Royal Aero Club appointed us their constructors of balloons for the Club. I suppose I am the oldest male living balloonist and have been concerned with all the subsequent development which has taken place, particularly the invention of stressed-skin metal construction, which I consider to be my major contribution to the aircraft industry. I continue to follow with keen interest the progress of aviation and if my brothers were still here they would join with me in wishing you all a most happy reunion. . . ."

Pressurized and air-conditioned: the new Alti-Cruiser.

NEW LIQUID-OXYGEN CONTAINER

A NEW type of container for liquid oxygen or nitrogen has been developed by the AiResearch Manufacturing Division of the Garrett Corporation. Made of two steel shells welded together to form a double-skinned unit, the new container requires 37 per cent less welding than previous units and the possibility of leaks is thereby reduced. Capacities of from five to 100 litres can be produced. A vacuum in the double-skinned shell provides insulation for storage of liquid oxygen at −297 deg F and liquid nitrogen at −318 deg F. Tests, it is stated, have shown that the shell can withstand 20g centrifugal loading and receive a direct hit from a 0.5in armour-piercing incendiary bullet without shattering. Missile and aircraft applications are possible.

AERO'S NEW COMMANDER

CLAIMED to be the first light twin executive aircraft to be pressurized and air-conditioned, the Alti-Cruiser version of the Aero Commander was "unveiled" in Oklahoma City last month. The new model is available as either a six-seater or a four-seater.

Instruments are grouped in three separate panels: (1) pilot's panel, with electrically operated flight instruments, (2) centrally located engine instruments, and (3) co-pilot's panel, with vacuum-operated flight instruments. Stratos cabin-pressurization and air-conditioning systems are fitted. A choice of three standard radio packages is available for communications and navigation.

In one of the three radio packages, the Wilcox Canari system, the units comprise a 20-channel ILS, glide-slope receiver, an ADF, a marker beacon receiver, a 560-channel communications receiver, two navigational receivers, two 360-channel communications transmitters, an audio mixer amplifier, a standby audio amplifier, and three loudspeakers. Flush Omni and ADF aerials are fitted; in addition, the communications and glide-slope aerials are internally mounted.

Service ceiling of the Alti-Cruiser is 25,560ft, and single-engined ceiling, 15,000ft.

BEA lead again!

British European Airways — who in 1957 ordered a fleet of Comets — have shown determination to maintain their lead in the new era of jet travel by choosing the DH. 121.

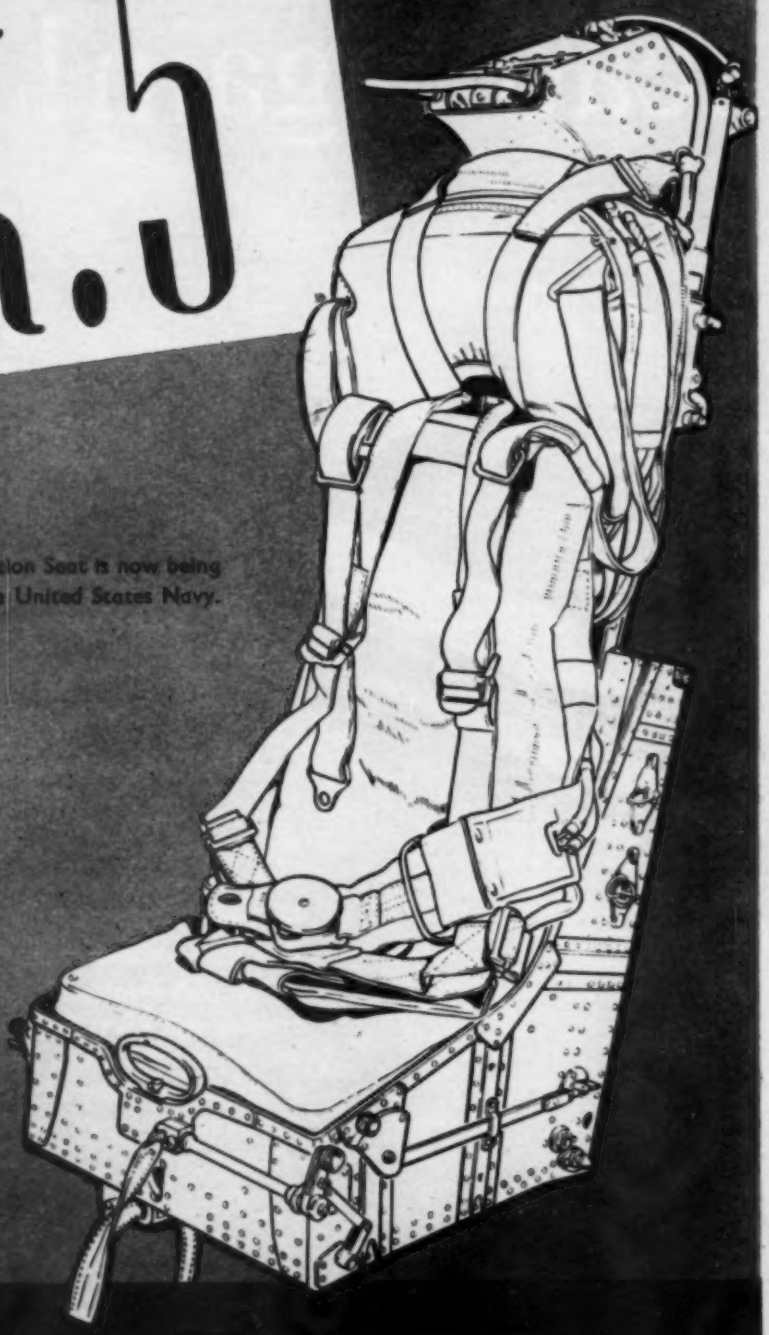
Both types are powered by Rolls-Royce engines.

The Aircraft Manufacturing Company Limited formed by de Havilland, Hunting and Fairey for the production of the DH. 121 possesses an unrivalled combination of technical and production resources with a unique experience of more than 12 years in the development of jet airliners.

BEA have chosen the DH. 121

Mk.5

The Martin-Baker Mk.5 Ejection Seat is now being delivered in quantity to the United States Navy.

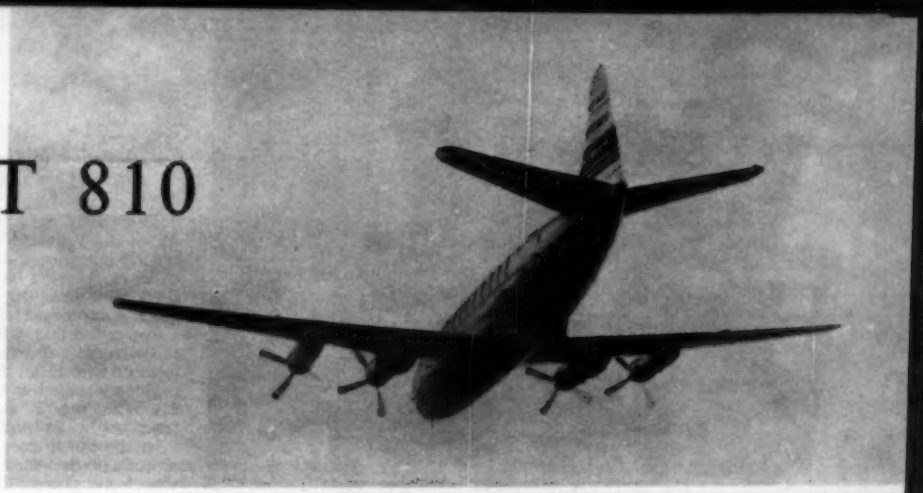


MARTIN-BAKER

Aircraft Company Limited

England & Canada

VISCOUNT 810



Latest and Fastest of a Famous Line

ON a cold, damp day just before Christmas, a new mark of Viscount made a short first flight from the main factory at Weybridge to nearby Wisley. This was Vickers' own 810/840 development aircraft, and the predecessor of a line of strengthened, faster Viscounts that will achieve their ultimate development some time in the 1960s. The first customer's aeroplane, an 812 for Continental Airlines, flew on February 14, and will be delivered during the spring.

Ten years' experience with a basic aircraft design is substantial background, by any standards, upon which to base a new development of an aircraft type. That in the years since 1948 Vickers-Armstrongs (Aircraft) have adjusted the Viscount to meet the individual needs of some 47 customers is commercial proof that adaptability and a willingness to learn bring their own reward. It is the very logic of the Viscount 810 that makes it difficult to discern where lie its roots; but operationally it can perhaps best be regarded as a faster successor to the Viscount 700, rather than to the shorter-range 800 series to which it bears a closer resemblance.

Certainly, development of the Viscount 810—and of its "400 m.p.h. Viscount" successor, the 840—is linked very closely with the name of Continental Airlines. As long ago as 1954, when Continental obtained approval to take over Pioneer Airlines' local service routes, they were interested in the turboprop Viscount, and their interest increased when they learned that well-respected K.L.M. had ordered 803s. But the U.S. airline's operations were such that they required both more power and more range than Vickers could offer with the 800 series Viscounts—although the increased capacity of this aircraft was about right for unit size. Additional power was available from the Dart, but to suggest that the *raison d'être* of the 810/840 was the Dart RDa.7, is to answer the conundrum of the chicken and the egg; airframe and engine are too closely linked in their development histories for their interdependence to be precisely analysed.

With suitable engines (Rolls-Royce had proposed the addition of a third turbine-stage to the Dart), Vickers were able to offer Continental an aircraft that would have an adequate performance out of the airline's hot and high home airport at Denver, with sufficient range for a non-stop operation to San Francisco or Los Angeles.

To look at the Viscount 810/840 structure gives little indication of the amount of exploration that went into the various development possibilities of the airframe. In order to provide more range with full payload, either additional tankage or a higher gross weight was required, along with more structure in the wing to meet higher landing weights and more in the fuselage and tail to cater for the additional speed. An entirely new airframe was even considered, but dismissed because of the very heavy amount of work that would be required. A new wing was another possibility, but this too was rejected as it became clear that the existing Viscount wing could be reworked to do the job; Lockheed's experience with the re-winged Constellation L.1649A, appears to have substantiated Vickers' conservative policy.

***Busy line:** An impressive number of Viscount 810 fuselages are now following almost complete V.806s through assembly at Weybridge.*

The rallying cry for the 810 (to which many operators responded with criticisms and advice) became "To clear up as many of the known Viscount deficiencies as possible without fundamental redesign" and the aircraft that resulted is a very saleable proposition ten years or more after its progenitor's inception.

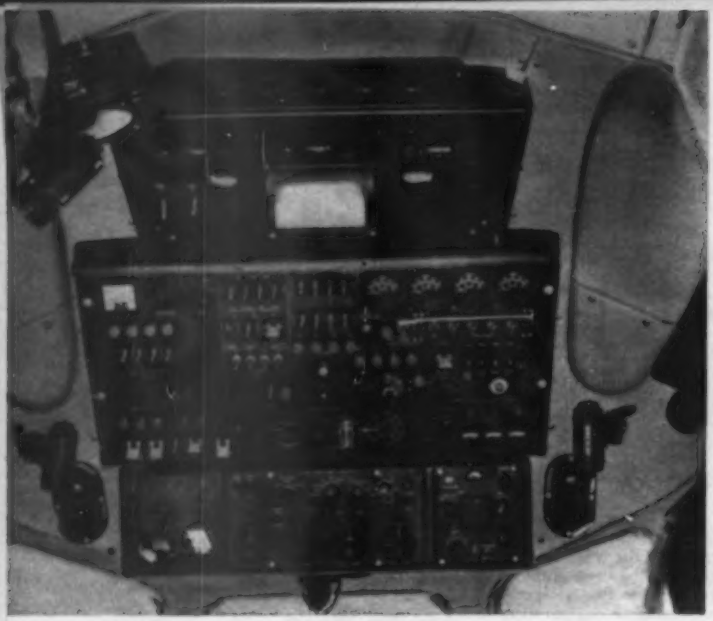
Although perhaps a little smaller than the ideal size, there continues to be a steady demand (as the order book for 45 Viscount 810 series clearly shows) for a 50/60-seat turboprop. Even at this size, on many routes up to about 700-800 miles, the 400 m.p.h. 840 Viscount will be competitive with the Electra, and on routes where the competitive climate is not so intense as it is in North America, on medium ranges the Viscount 810 still represents "the best Viscount yet." On short and very short ranges other aircraft in the family—either the 790 or 800—may represent better value; inevitably the first cost of the latest Viscount 810/840 series has crept up above its predecessors and reflects less favourable direct operating costs over ranges where the 810's higher block speed cannot be brought to good account.

The cost per seat-mile is about the same, however, as that of the Viscount 800, and because a similar amount of fuel is used per mile, the overall economy can be shown to be a little better. The extended payload/range curve of the 810 and seat-mile costs that do not vary appreciably over quite a wide band of altitude represent, in fact, the "flexibility" which is such an essential operational feature. Seat-mile costs are claimed to be equal or better than existing equipment on stages down to 150 miles.

One way in which the revised design for 400 m.p.h. airspeeds (obtained with the 840 between altitudes of 15,000 and 20,000ft at maximum take-off weight, maximum recommended cruise power and on a standard day) has been put to good effect is to raise the normal operating limit speed V_{NO} from 235 kt to 274 kt e.a.s. at sea level, with a subsequent gain at all altitudes up to about 21,500ft, above which V_{NO} is limited by Mach number. The result, in practice, will be very gratifying to Viscount pilots who have suffered the indignity of being passed on the descent by the DC-6Bs that they had easily outpaced while cruising.

The weight penalty of operating an aeroplane stressed for a potential 400 m.p.h. at the rather lower cruising speed of the 810 (nominally 365 m.p.h. at 20,000ft) is, in fact, quite small; partly because of the extended limitations of the flight envelope, but also because the difference in indicated cruising speeds is not, in effect, very great. Designing the aircraft for a high rate of descent and a wide band of operating altitude at 365 m.p.h. left a fairly limited altitude at which 400 m.p.h. could be achieved on a standard day. All aircraft experience a decline in performance on hot days, and only the 840 really has the reserve of power to achieve 365 m.p.h. throughout the year under all anticipated conditions of weight and temperature. In any case the structural penalty is small compared with the weight of the many optional extras which are now offered. (On sophisticated routes, such as those in North America, airsteps, propeller braking, freon refrigeration and so on are more frequently fitted than not.) The Viscount 840 will have an initial maximum take-off weight 1,500 lb greater than the 810, which far exceeds the additional 100 lb-odd per engine on the empty weight.

Although the re-engining of a civil transport in service has yet to be done on a commercial scale, the Viscount 810 does offer the possibility of direct conversion to RDa.11 powers in early 1960, with minor structural modification required only to the nacelles.



Complementary to the instrument panel photograph below is this picture of the roof radio panel of Continental Airlines' 812.

VISCOUNT 810 . . .

Continental Airlines have expressed their intention of converting to "400 m.p.h. Viscounts" (with their obvious sales appeal) when the engines become available, but many other customers may be expected to take factory deliveries of new 840s in the 1960s.

With re-engining to 2,100 shaft power for take-off in prospect, it is tempting to ask why the 1,910 shaft horse power engine should need to be de-rated for take-off to 1,750 s.h.p. The short answer is that the maximum available power from the Dart 525s is not required, and the engine is therefore physically restricted through the fuel control unit so that unnecessary fuel is not used. It does not always follow that additional power will result in a greater margin of safety over the WAT curve limitation; for example, if more power is used for take-off, the aircraft's asymmetric yawing moment increases and the take-off safety speed is correspondingly raised.

In any case, the important thing is to have the necessary power under the critical condition, not merely to have an excess under the non-critical sea-level conditions. This is precisely what the Dart de-rating achieves.

There is an optimum power for the aircraft weight, and this is set on the Viscount 810 at 1,800 s.h.p. Other advantages follow in train: the limitation on maximum power enables a rather lighter reduction gearing to be used than would otherwise be the case, along with a smaller propeller shaft, lighter propeller design and much reduced water/methanol consumption.

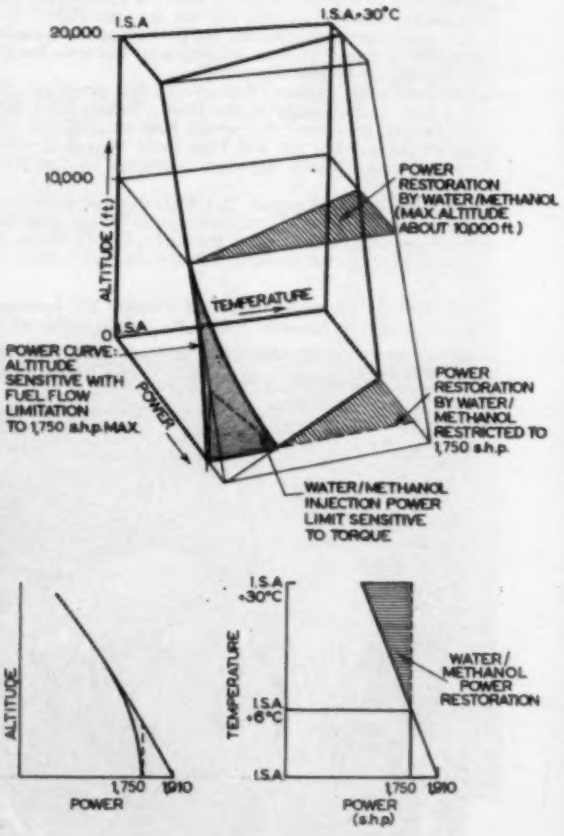
Power-limiting of the engines in this way is illustrated on the accompanying three-dimensional graph; the effect will be familiar to those who recall the "rated altitude" of piston engines. On the engines installed in the Viscount 810 (four Rolls-Royce RDa.7/1 Mk 525B) the "B" suffix denotes that a capsule has been removed from the water/methanol injection unit so that it has become insensitive to altitude; injection consequently restores power at any altitude (within the confines of the altitude/power curve) to 1,750 shaft horse power. The dotted triangle on the graph illustrates the 1,750 s.h.p. boundary of this effect. With the RDa.11 engine, the parameters of the curve are modified; the maximum shaft horse power of 2,400 is limited to 2,100 for take-off. Even so, water/methanol injection will not be required at temperatures below I.S.A. + 28 deg C—it will be needed, in fact, on very few occasions.

The aircraft described in detail in this article is the Viscount 812, 15 of which have been ordered by Continental Airlines of Denver, Colorado, who refer to the aircraft as the Viscount 2. The specification hence includes many items of American equipment, but the structure is naturally common to all 810/840 airframes. The Continental aircraft do, however, provide a good example of the additional equipment that is required to offer competitive service in the U.S.A.

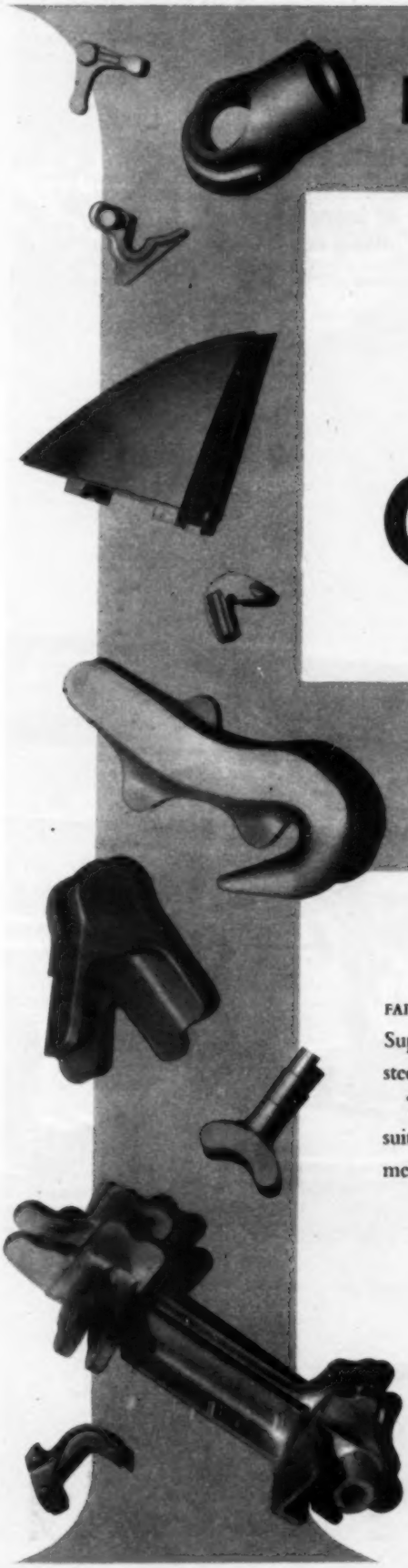
Structure. The dimensional envelope of the 810 is almost identical to that of the 800; the fuselage is 46in longer than the 700 and the pressure bulkhead has been moved 65in further aft.

Some adjustment has been made to the fuselage jigging to allow the back-to-back channel-section frames which carry the spar loads into the fuselage to be opened .040in to accommodate the dimensionally-increased top and bottom spar booms. Weather radar, familiar in the nose of 700 series Viscounts, has again been fitted. The forward entrance door is slightly smaller than the special-purpose door of the 800 series Viscounts, and for Continental Airlines this revised door includes a built-in Airstep. In order that the modified floor in the region of the Airsteps may be fully utilized when the steps are not fitted, a light alloy fairing covers the recessed floor. The hydraulic jack and airstep linkage is mounted under the floor, but the controls are situated on the bulkhead. An additional 11 cu ft of underfloor freight space is available when airsteps are not fitted. An emergency button releases

(Right) A three-dimensional explanation of the effect of de-rating the powerplants to 1,750 s.h.p. for take-off. Fall-off in power with altitude and temperature is shown separately in the lower drawing, and the upper curves are combined above to show the effect of water/methanol injection.



Centered in the 812 cockpit layout is the scope of the R.C.A. AVQ-10 weather radar; to accommodate it the torquemeters have been paired. Note that 4in-diameter instruments are used on the Collins FD-105 flight system, which is combined with a Bendix PB-10 autopilot into which radio information can be coupled.



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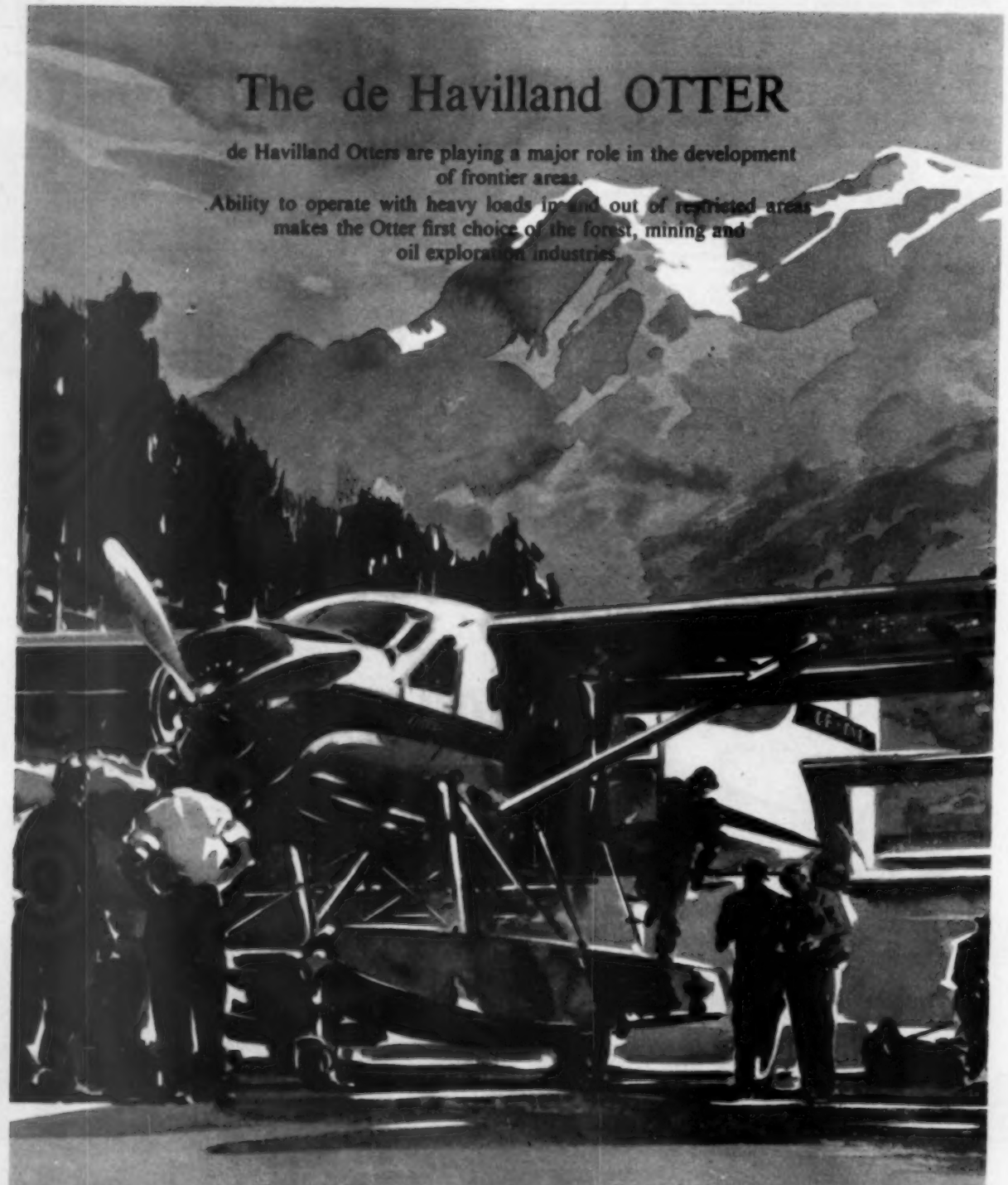


Designed and built by

THE DE HAVILLAND AIRCRAFT OF CANADA LIMITED

DOWNSVIEW, P.O. TORONTO, ONTARIO

VISCOUNT 810 . . .

hydraulic pressure from the "up" side of the actuating jack and the airstep can then be pushed out by hand. An over-centre lock ensures the rigidity of the steps in the down position, but they are pivoted at the door sill and carry casters at the base of the lowest tread to accommodate variations in fuselage attitude.

There are now two rear doors aft, disposed port and starboard to meet C.A.A. evacuation requirements. The port door may be used for passenger loading and the starboard door can serve as useful access for loading pantry stores. Aircraft that come under C.A.A. jurisdiction have escape hatches on the forward window on the starboard side and on windows 6, 7 and 8 over the wings on both sides of the fuselage. Where a rear lounge replaces the rear upper freight hold (as on the 812) two more small windows are provided and new intercostal members above and below the window carry the additional loads. The rear freight door is not fitted when a lounge is installed.

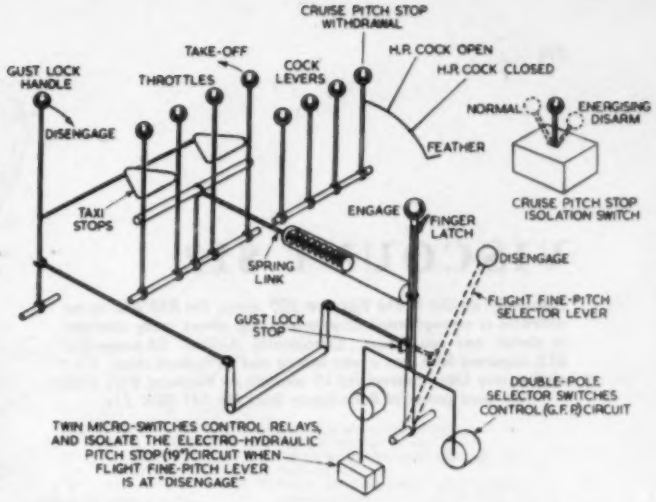
Most of the additional strengthening concerns details only; the tail cone area has been stiffened to carry increased tail loads and small structural changes have been made to accommodate various aerials and flashing beacon lights at the top and bottom of the fuselage. The corrugated skin of the luggage bay floor has been changed for a sandwich construction with a smooth floor surface which makes it easier to handle the luggage and also to keep the bay clean. A modification has also been made to the nosewheel doors and bay, which have been extended 1.9in to accommodate the longer stroke undercarriage.

In order to cater for a maximum landing weight of 60,000 lb (that is, an increase of 1,500 lb over the Viscount 800 series) changes have been made to the wing structure and main undercarriage. The most important of these is an all-round dimensional increase in the T-section spar booms. Local modifications have also been made to leading and trailing edge members, spanwise members and their respective attachments. As shown upon the cutaway drawing, the Vickers-designed undercarriage has been stiffened for the Viscount 810 and the geometry slightly revised. To cater for the increased landing loads a longer stroke undercarriage has been fitted and the main chassis ribs have been strengthened. Structural provision has been made such that the Dart 541 can be installed without further structural alteration.

To meet C.A.A. requirements for water/methanol injection, larger (55 Imp gal) water/methanol tanks, similar to those needed on 700 series Viscounts, are provided in each wing. Rather less water-methanol will be needed with the Viscount 840 since there is a higher power reserve in the engine fitted. The four-tank fuel system comprises 20 Marlite nylon fuel cells with a total capacity of 1,900 Imp gal—a few gallons less than the 800 series aircraft due to the water-methanol system. A fuel jettison system has been provided for Continental aircraft—once again a C.A.A. requirement—similar to the system evolved for Capital's Viscount 745s; it consists essentially of two pumps and an electrically-controlled dumping valve for jettisoning the required amount of fuel. Provision is also made for mounting two 145 Imp gal slipper tanks externally on the wings, as an optional extra.

Flying Controls. To cater for the higher tail loads, the tailplane —identical in appearance with earlier Viscounts except for an asymmetric tab configuration—has been strengthened by thickening the skin and increasing the dimensions of the spar webs, chordwise sections and local attachments. Other modifications to the flying controls also result directly from their adaptation to a higher performance aeroplane. Some local strengthening to the control rods has been made and improvements have been made to the tab stiffness by fitting honeycomb-foam filled tabs.

The spring-loaded cable which actuates the control lock plunger



Undercarriage micro-switch selection of ground fine pitch has been replaced—on the 812—by a manual lever. Its operation, and that of the gust-lock control, is discussed in the text.

from the cockpit has been replaced by a double wire run with a positive return. The flying control runs have also been modified so that the servo motors of the Bendix PB 10 autopilot are now situated directly under the tail surface torque tubes, where the inevitable small amounts of friction, break-out force and backlash in the control circuit are eliminated—the result should be a much better standard of control than is possible with the autopilot servos under the pilot's floor. (The Bendix PB 10 autopilot, coupled with the Collins FD 105 Integrated Flight System, is fitted to the Viscount 812; the standard Viscount 810 installation is the Smiths Flight System with S.E.P.2 autopilot.)

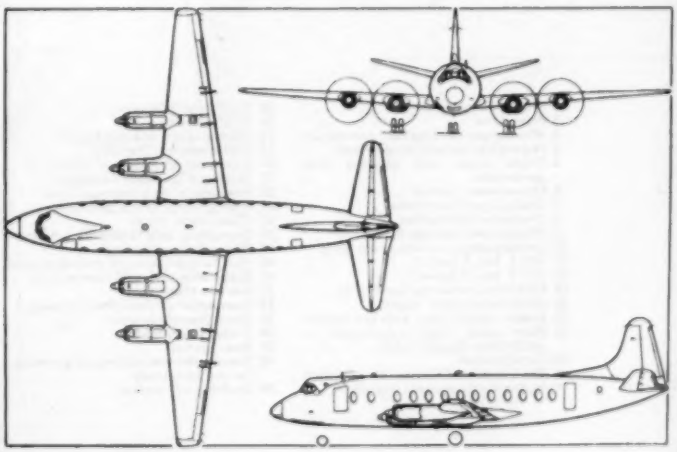
The Bendix autopilot includes a torque-limiting device on the elevator which causes a break link to operate against a predetermined spring force if the autopilot torque exceeds a certain value. Operation of the break link also trips a micro-switch which cuts out the autopilot servo motor and hence prevents excessive loads being transferred to the control surfaces; if the condition passes, the break link springs back and the autopilot resets.

Propeller and Engine Controls. Introduced on the 810, is the new Rotol 2-step lock propeller with trapezoidal plan-form blades and an activity factor of about 160. This propeller is controlled by a revised control lever layout in the cockpit, with a manual selector for ground fine pitch in place of the undercarriage-tripped micro-switches used in the past; this is again a requirement of the C.A.A. The layout is shown diagrammatically in the accompanying sketch. Also shown is the improved control gust-lock arrangement that mechanically prevents selection of flight fine pitch with the aircraft on the ground and the gust-lock in, although in this condition any two engines may be run-up to take-off power for ground-testing purposes.

Four positive propeller-pitch positions are provided: Feather, "high stop" cruise pitch lock (35 deg blade angle), flight fine "low stop" pitch lock (23 deg) and ground fine pitch (19 deg) for engine starting and minimum drag on the ground. The new lock position —for cruise pitch—has been added to cater for the additional power of the Dart 525 and higher speed of the 810. Should a hydraulic

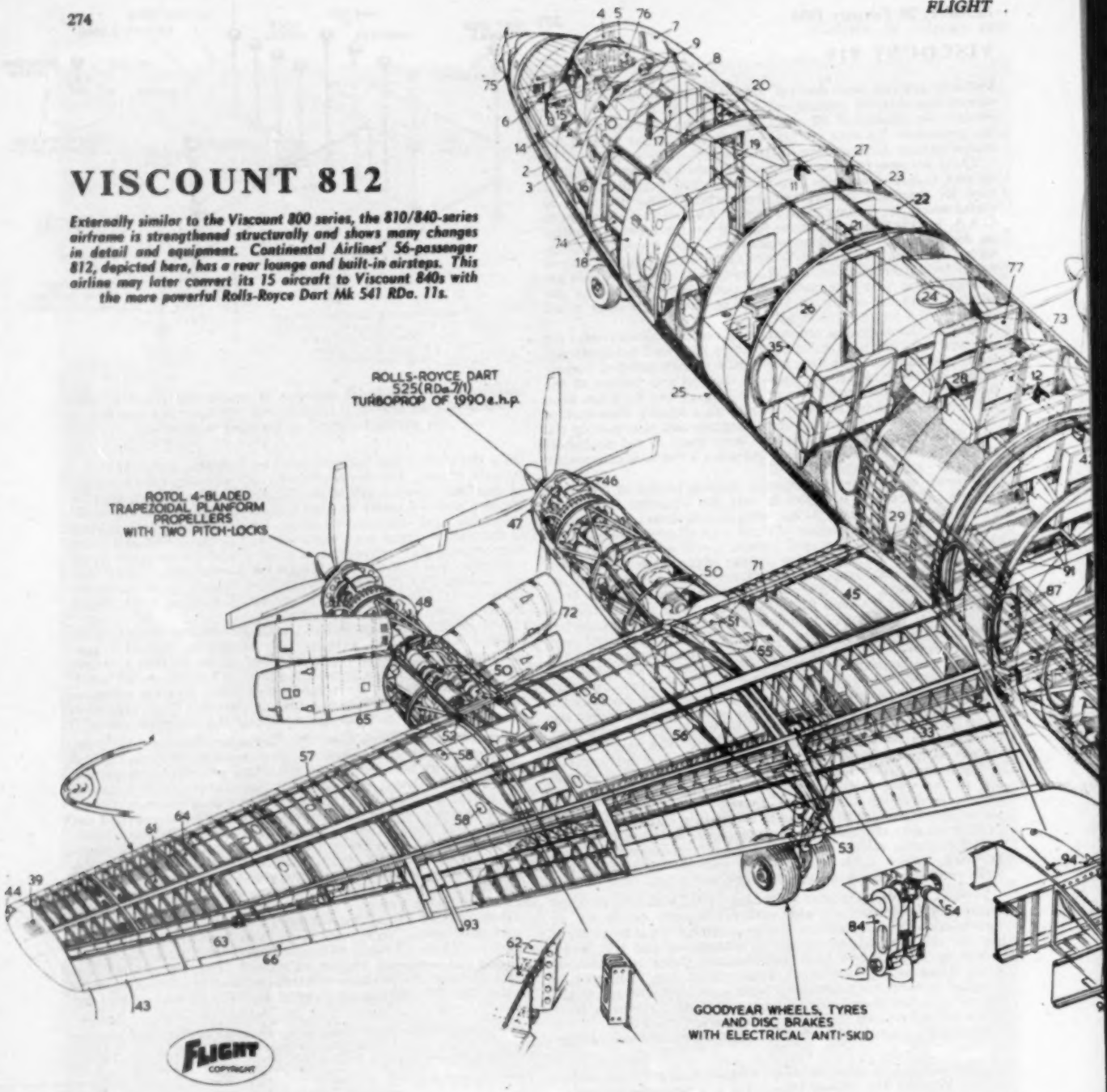
(Overleaf is a double-page drawing of the Viscount; and this description is continued on page 280)

The rear lounge, with small additional windows, is an attractive feature of the Viscount 812. Behind the curtain is a passenger wardrobe.

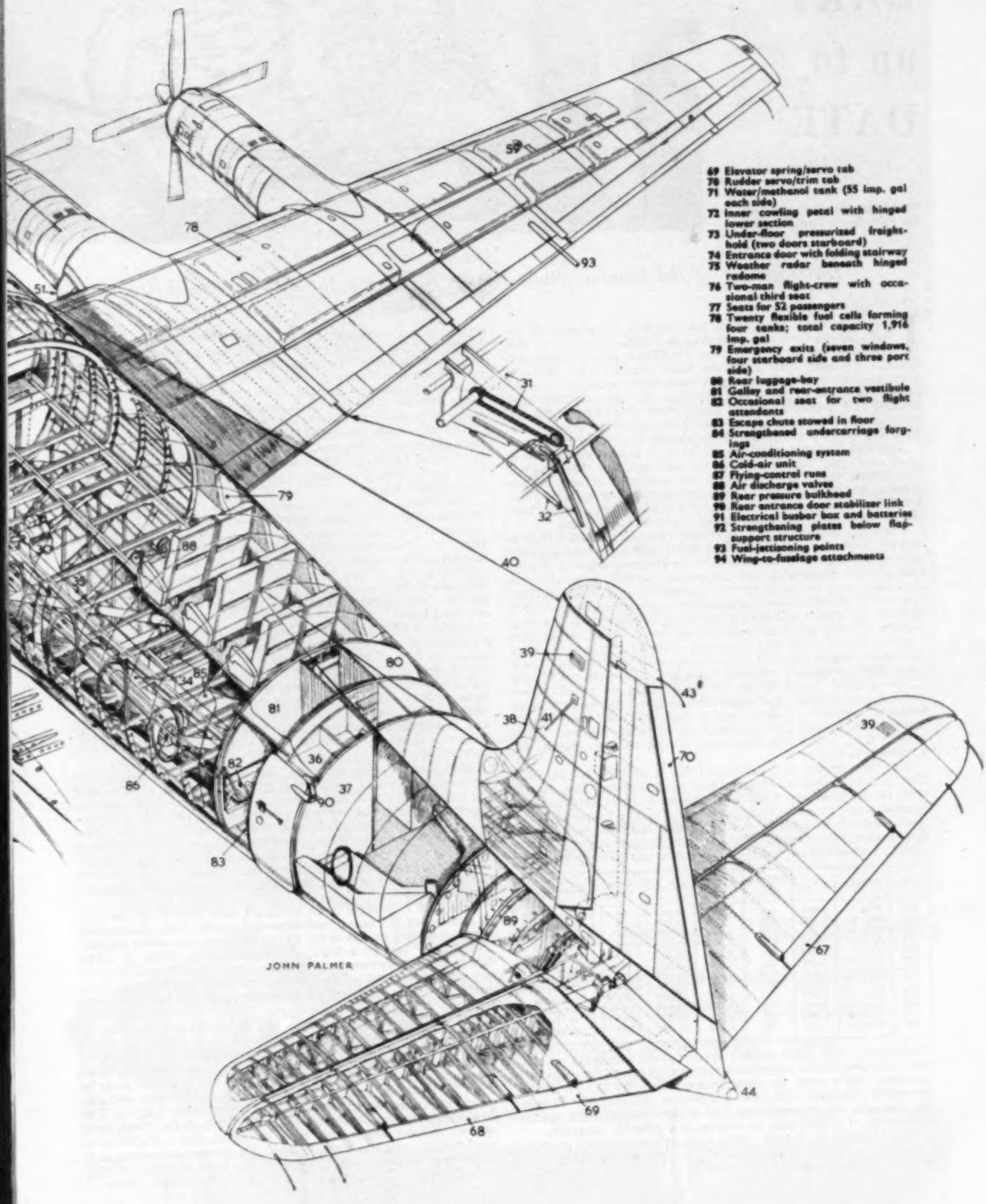


VISCOUNT 812

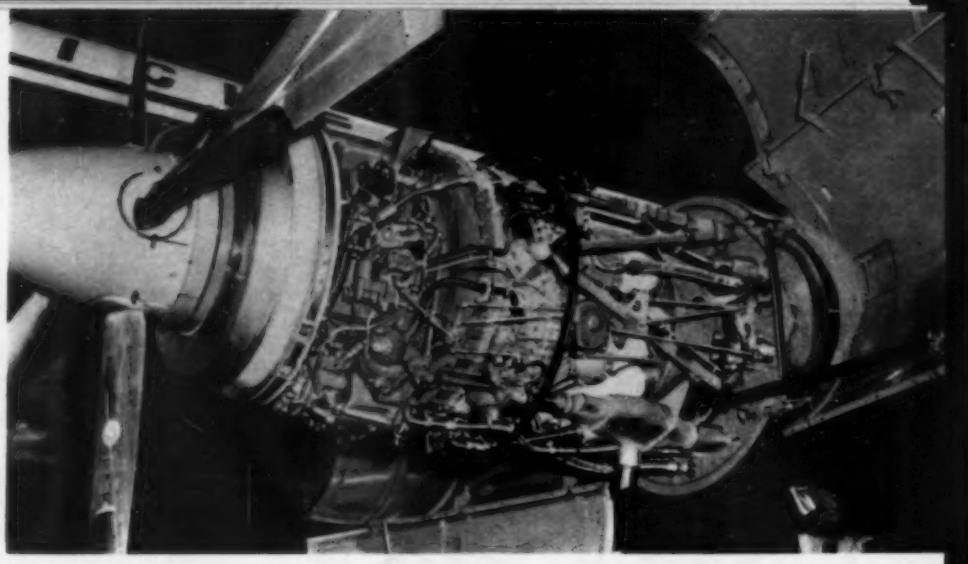
Externally similar to the Viscount 800 series, the 810/840-series airframe is strengthened structurally and shows many changes in detail and equipment. Continental Airlines' 56-passenger 812, depicted here, has a rear lounge and built-in airsteps. This airline may later convert its 15 aircraft to Viscount 840s with the more powerful Rolls-Royce Dart Mk 541 RDa. 11s.


ROLLS-ROYCE DART 525(RDa.7/1) TURBOPROP OF 1990 e.h.p.
ROTOL 4-BLADED TRAPEZOIDAL PLANFORM PROPELLERS WITH TWO PITCH-LOCKS
GOODYEAR WHEELS, TYRES AND DISC BRAKES WITH ELECTRICAL ANTI-SKID
FLIGHT COPYRIGHT

1 Warm air to cockpit
2 Pitot head
3 Windscreen de-icing fluid connection
4 Nesa-glass heated windscreens
5 Triple wiper and de-icing fluid spray-bars
6 Direct-vision panels
7 Cockpit pressure dome
8 Unpressurized fairing
9 Windscreen de-icing fluid tank
10 Leading-edge ice-inspection lamp
11 V.H.F. No. 1 aerial
12 V.H.F. No. 2 aerial
13 Nosewheel-steering handwheel
14 Aerocharm pilots' seats
15 Rudder-pedal units with toe brakes
16 Main radio crate (remainder in under-floor freight hold)
17 Cockpit door
18 Towing point (scissor link released)
19 Hydraulic-equipment cupboard
20 Hydraulic-fluid tank
21 Ship's library
22 Toilets—port and starboard
23 Public address (Bendix)
24 A.D.F. aerial (Marconi 7092C)
25 Ice-guard (beneath fuselage)
26 Passengers' light-luggage rack
27 Sliding curtains (no sunblinds)
28 Chair-back tables
29 Emergency exit (external release)
30 Flap motor and gearbox
31 Flap torque-tube and driving chains
32 Flap guide-rails and radius arms
33 Aileron control run
34 Intercooler airflow (flush intake)
35 Conditioned-air duct
36 Galley equipment
37 Rear lounge
38 Double-skinned leading-edge (wing, fin and tailplane)
39 De-icing air outlets
40 H.F./Loran aerial (for ferry only)
41 V.O.R. and I.L.S. localizer aerials
42 "Pounder"-type anti-collision beacon
43 Static dischargers
44 Navigation lights
45 Bag-type fuel tanks
46 Airflow through oil cooler
47 Electric de-icing pads
48 Firewall
49 Fire-suppression bottle; three spray rings in nacelle
50 Rotol accessory gearbox on each engine, driving Godfrey cabin blowers, generators, hydraulic pumps and propeller de-icing alternator
51 Cabin blower delivery duct (intake on nacelle flank)
52 Main engine mounting point
53 Vickers 14in-stroke undercarriage
54 Retraction jack
55 Retraction bay
56 Jet-pipes
57 Tank access-panels in bottom surface of wing
58 Covers for Pacitor gauges
59 Float-switch covers
60 Gravity-filling point (pressure refuelling below wing)
61 Landing lamp
62 Access to outer-wing attachment bolts
63 Irving-balanced split ailerons, skew-bar operated
64 Nine ribs only in each wing, plus light chordwise members
65 Outer cowling petal with hinged top section
66 Aileron balance tab
67 Elevator trim tab
68 Elevator anti-balance tab


69 Elevator spring/servo tab
70 Rudder servo/trim tab
71 Water/methanol tank (55 Imp. gal each side)
72 Inner cowling petal with hinged lower section
73 Under-floor pressurized freight-hold (two doors starboard)
74 Entrance door with folding stairway
75 Weather radar beneath hinged radome
76 Two-man flight-crew with occasional third seat
77 Seats for 52 passengers
78 Twenty flexible fuel cells forming four tanks; total capacity 1,916 Imp. gal
79 Emergency exits (seven windows, four starboard side and three port side)
80 Rear luggage-bay
81 Galley and rear-entrance vestibule
82 Occasional seat for two flight attendants
83 Escape chute stowed in floor
84 Strengthened undercarriage forgings
85 Air-conditioning system
86 Cold-air unit
87 Flying-control runs
88 Air discharge valves
89 Rear pressure bulkhead
90 Rear entrance door stabilizer link
91 Electrical busbar box and batteries
92 Strengthening plates below flap-support structure
93 Fuel-jettisoning points
94 Wing-to-fuselage attachments
JOHN PALMER

DART up to DATE



Power for the Viscount 810: the Rolls-Royce Dart RDa.7/1.

Development of the Famous Rolls-Royce Turboprop for the Viscount 810

IT is now some years since the first full description of the Rolls-Royce Dart was published in *Flight*. The engine described on March 20, 1953, was the RDa.3, as was installed in B.E.A.'s Viscount 701s under the mark number 505. None of these engines is still flying, as all have been converted to Dart 506s—which are de-rated to 1,400 s.h.p. for take-off; they have thinned and polished rotating guide vanes and improved guide vanes on the high-pressure turbine. This engine was described in an article on Dart development on January 14, 1955.

Dart and Viscount development have, of course, gone hand in hand ever since the inception of the airframe; and when, earlier this month, the Viscount passed the landmark of one million revenue hours, so did total Dart hours exceed four million. Over 2,000 Dart engines of all marks have been built and the overhaul life in North America is now in the region of 1,700 hours.

These are impressive figures by any standards, yet the Dart is still by no means at the end of its development life and patently only at the beginning of many new civil partnerships: A.W.650, Dart Herald, Friendship and Gulfstream, as well as installations that have been prepared for the Accountant and Bréguet Alizé. It seems likely, with many components now reaching lives of 3,000 or 4,000 hr, that it will not be very long before engine overhaul periods of over 2,000 hr might be achieved. This would give a gas turbine, for the very first time, a longer overhaul life than any piston engine has ever had: Chicago and Southern Air Lines (now Delta) eventually achieved 2,000 hr "pulls" with the Wright C.18s of their Constellation 749s—although, as in all piston engines, plug changes and tappet checks had to be made at more frequent intervals. Trans-Canada Airlines, who have so far achieved the longest Dart overhaul period of any operator (1,800 hr with their RDa.3 Mk 506s) have already run two engines for a 2,000 hr period.

The Dart engine in the Viscount 810 is an RDa.7/1 Mk 525. This is a basic Mk 520 engine with a recalibrated flow-control unit, increased cruise flame temperature and modified controls incorporating an additional pitch stop for the propeller. The shaft horsepower at sea level is 1,800 with 500 lb jet thrust. The designation system has become, over the range of engines, a little complicated to follow, but the table below should help to clarify

Mk	Rating	s.h.p.	Thrust (lb)	t.e.h.p.	r.p.m.	Gear ratio	Application
505	RDa.3	1,400	365	1,540	14,500	0.106 : 1	Viscount 700
506	RDa.3	1,400	365	1,540	14,500	0.106 : 1	Viscount 700
510	RDa.6	1,600	370	1,740	14,500	0.093 : 1	Viscount 800
511	RDa.6	1,600	310	1,720	14,500	0.086 : 1	Friendship
520	RDa.7	1,700	495	1,890	15,000	0.093 : 1	Viscount 806
525	RDa.7/1	1,800	500	1,990	15,000	0.093 : 1	Viscount 810
526	RDa.7/2	1,910	505	2,105	15,000	0.093 : 1	A.W. 650
527	RDa.7/2	1,910	505	2,105	15,000	0.093 : 1	H.P. Herald
528	RDa.7/1	1,800	415	1,960	15,000	0.093 : 1	Friendship
529	RDa.7/2	1,910	505	2,105	15,000	0.093 : 1	Gulfstream
540	RDa.10	2,400	670	2,660	15,000	0.093 : 1	—
541	RDa.11	2,100	655	2,350	15,000	0.093 : 1	Viscount 840

the position. The mark number applies to the particular installation; it is also almost completely accurate to say to the particular customer, since even the most minor change (which is almost invariably required) calls for a different designation. It may, for example, be necessary to run a fire-warning wire a little differently, or a label may be written in a different language.

The Ministry of Supply rating nomenclature applies to basic variations in the development of the engine and the suffix to its "tune." Thus the RDa.7/1 (1,800 s.h.p.) is a de-rated engine, although it is confusing that the standard engine is the RDa.7/2 (1,910 s.h.p.) and the 7/1 and 7 (1,700 s.h.p.) are variations. The final point to appreciate is that after a trial of suffix additions for rating variations from a particular standard of engine, the method of nomenclature was changed; the de-rated RDa.10, for example, is the RDa.11. This is a much simpler method—always provided it can be remembered where the change took place.

The RDa.7 was developed from the RDa.6 and the latter engine from the RDa.3. This earlier stage of development was described in *Flight* of March 20, 1953; but before bringing the development story up-to-date, it is worth recalling a little of the earlier Dart development history.

The form of the basic engine, with its two stages of centrifugal compression, seven canted combustion chambers and two-stage turbine is too well known to need re-description here. It is the Dart 506 version upon which, perhaps more than any other, the wonderful Dart reputation is based; but now at least 24 customers (including B.E.A. and Capital, the two airlines with the largest Viscount fleets) have aircraft equipped with the Dart 510 engine, and by 1956, 93 per cent of all engines were achieving their full overhaul lives.

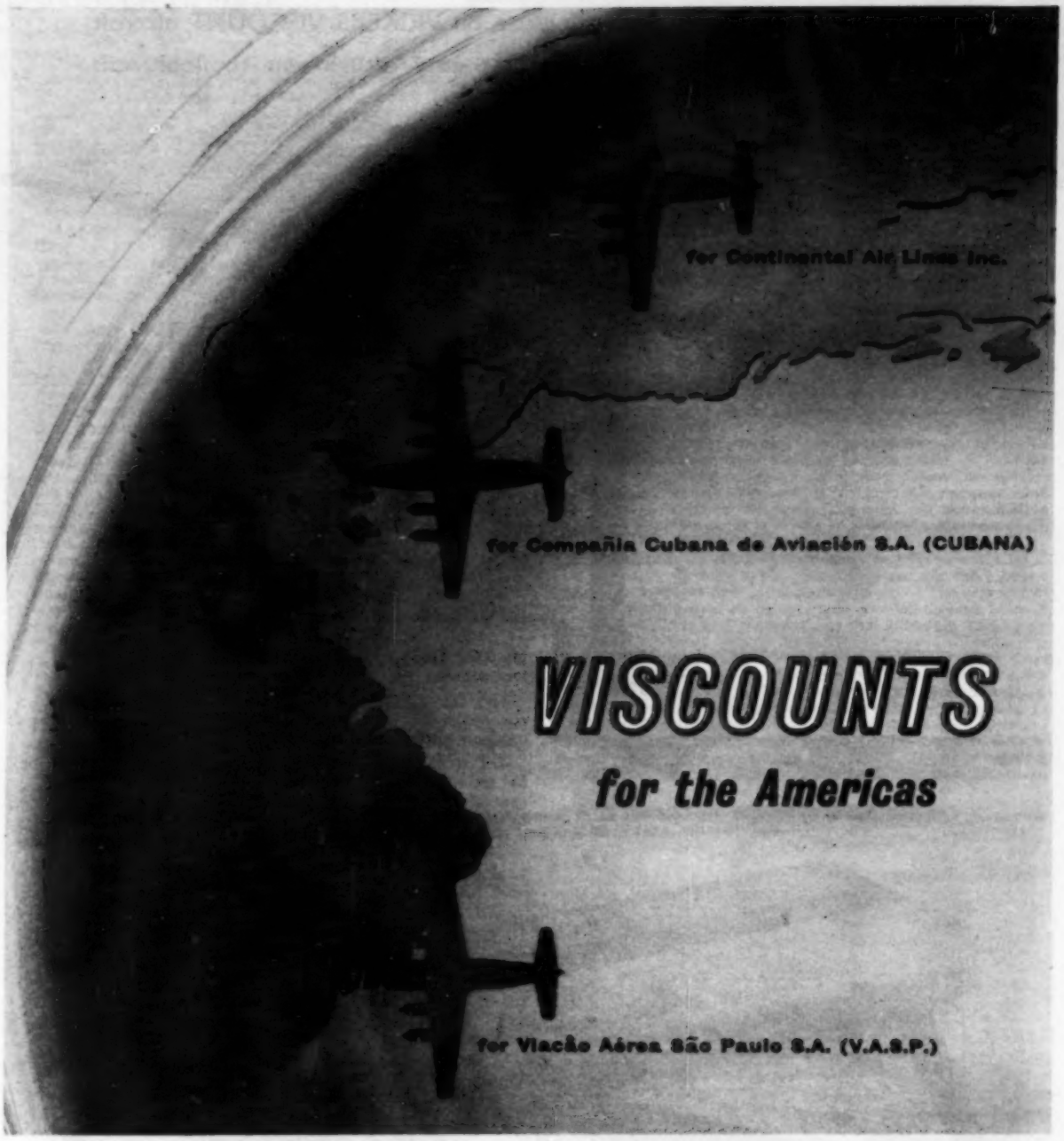
Briefly, the RDa.6 differed from earlier engines in that it had a redesigned reduction gearing with a helical low-speed gear train, wider teeth and larger bearings. As the table in column 1 shows, this engine introduced a lower speed ratio between propeller shaft and turbine gearing, with a consequent reduction in noise because the propeller tip speed was lower. An increase in efficiency was obtained by one other modification: on both high- and low-pressure turbine blades triple tip-seals were fitted to reduce spillage. This engine went into production during the summer of 1955.

Development work on every Dart component is a continuous process—particularly so with so many engines in service—and the next stage, the RDa.7, is best visualized as a logical coming-together of work and experience with the RDa.6. The manufacturers steadfastly maintain that there is nothing in the least remarkable about the RDa.7, that every change from the RDa.6 was only to be expected if Rolls-Royce philosophy was properly understood, and that every mechanical change was made with the greatest reluctance. But then, the Derby firm have exceptional standards.

The RDa.7, in spite of an increased mass flow of 10 per cent, an increase of 365 t.e.h.p. and improved specific fuel consumption, is certainly very similar to the RDa.6 and hence, to earlier engines. The RDa.7 carries a basic shaft-horsepower rating of 1,910, achieved by an increase in mass flow from about 20 to 22 lb of air per second, and by an increase in cycle temperature. In comparison with the RDa.6, the flame temperature has been increased by about 15 deg C.

The additional air throughput has been obtained firstly by an increase in maximum r.p.m. for take-off from 14,500 to 15,000 (from which there is an associated temperature-rise) and also by physical changes. Of the latter, one of the most significant is an increase in the diameter of the second-stage impeller rotor by 0.4in to 17.6in in order to increase the pressure ratio and efficiency above its former value; it is now nominally 5.62 : 1. The first-stage rotor remains unaltered; and, although the throat areas of both diffuser stages have been increased, and a double-sided steel diffuser ring has been adopted, the compressor casing is no larger than in early engines—indeed, the basic castings throughout are largely identical.

[*Continued on p. 277*


for Continental Air Lines Inc.
for Compañia Cubana de Aviación S.A. (CUBANA)
VISCOUNTS
for the Americas
for Viacão Aérea São Paulo S.A. (V.A.S.P.)

GOODYEAR
AVIATION DIVISION

The new Vickers Viscount 810-840 Fleets
for these Airlines are to be equipped with
TUBELESS TYRES · WHEELS · BRAKES
BRAKE CONTROL EQUIPMENT AND
ANTI-SKID SYSTEMS

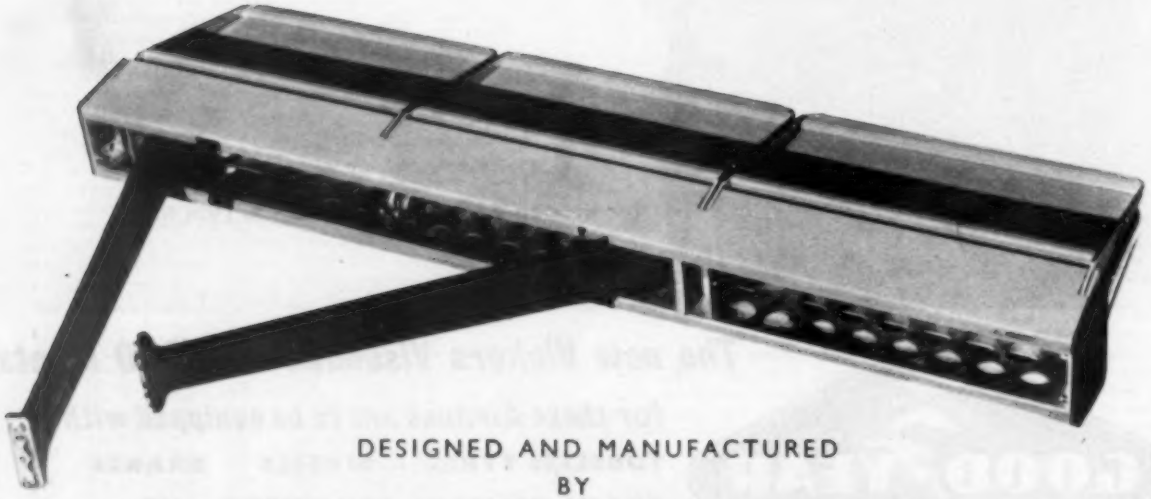
THE GOODYEAR TYRE & RUBBER COMPANY (G.B.) LIMITED · AVIATION DIVISION · WOLVERHAMPTON

6-Seater Pullman passenger table for use on VICKERS VISCOUNT aircraft, incorporating special clamping device for easy attachment to floor rails.

Manufactured in two forms, i.e. four-seater, and six-seater units, installed as standard equipment by B.E.A.

The leaves are constructed of light alloy, Vynide covered, with anodised aluminium frame. They can be independently operated.

The stove-enamelled legs fix rigidly to the floor rails by means of a toggle action clamp and fold into the centre section of the body for ease of stowage when not in use.



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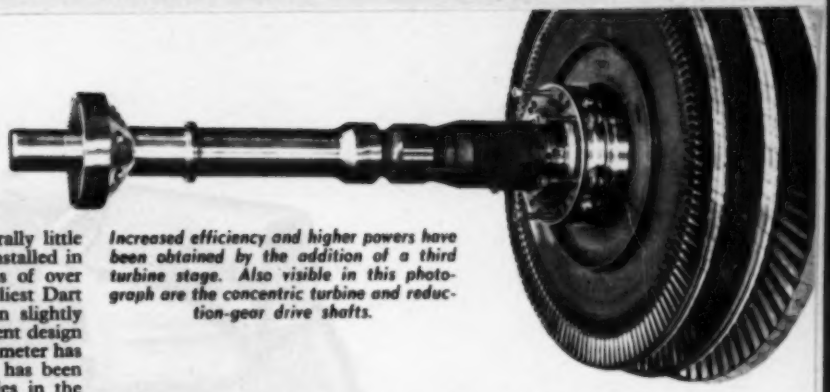
DART UP TO DATE . . .



Increased efficiency and higher powers have been obtained by the addition of a third turbine stage. Also visible in this photograph are the concentric turbine and reduction-gear drive shafts.

The seven combustion chambers, while again generally little changed, show a small performance-gain over those installed in the RDa.6. The flame-tubes, already exceeding lives of over 3,000 hr without repair in production engines (the earliest Dart tubes were changed at 700 hours or less), have been slightly modified for the RDa.7, and are of optimum development design and therefore acceptable for production. The outlet-diameter has been increased and the pressure-loss through the can has been reduced by increasing the number of tertiary air holes in the combustion chamber.

As shown in the drawing overleaf, the number of Clark cooling rings has been increased to three. This is the first production engine to be so equipped, although Rolls-Royce have been developing three-ring tubes since late 1954, and two cooling-strip flame-tubes were fitted to Mk 510 engines in production. A certain amount of discretion has to be exercised in fitting these cooling strips, for at lower chamber pressure ratios they are less effective and so reduce can life; the present design is matched to the increased flame temperatures of the Dart 525 tubes, but it can safely be assumed that flame-tube development will continue throughout the life history of the Dart.

The most important change made to the RDa.7 engine, and certainly the primary distinguishing feature, is the addition of a third turbine stage. This is not a complete innovation for the Dart, as a three-stage turbine was married to a Dart 510 compressor for the Mk 21 engine developed for the Bréguet Alizé.

The third turbine stage is, in fact, an addition with which Rolls-Royce have been experimenting for some years: a three-stage turbine was envisaged for the still-born Dart RDa.5, and the development work for this engine—and a good many hours of cold air rig and engine testing—provided useful experience when it was needed for the RDa.7. Introduction of the three-stage turbine has partly been adjusted to suit airframe needs; it was more logical to develop the 505 and 506 two-stage turbine engines to give additional power in Mk 510 form than it was to branch out at once with a more complex design.

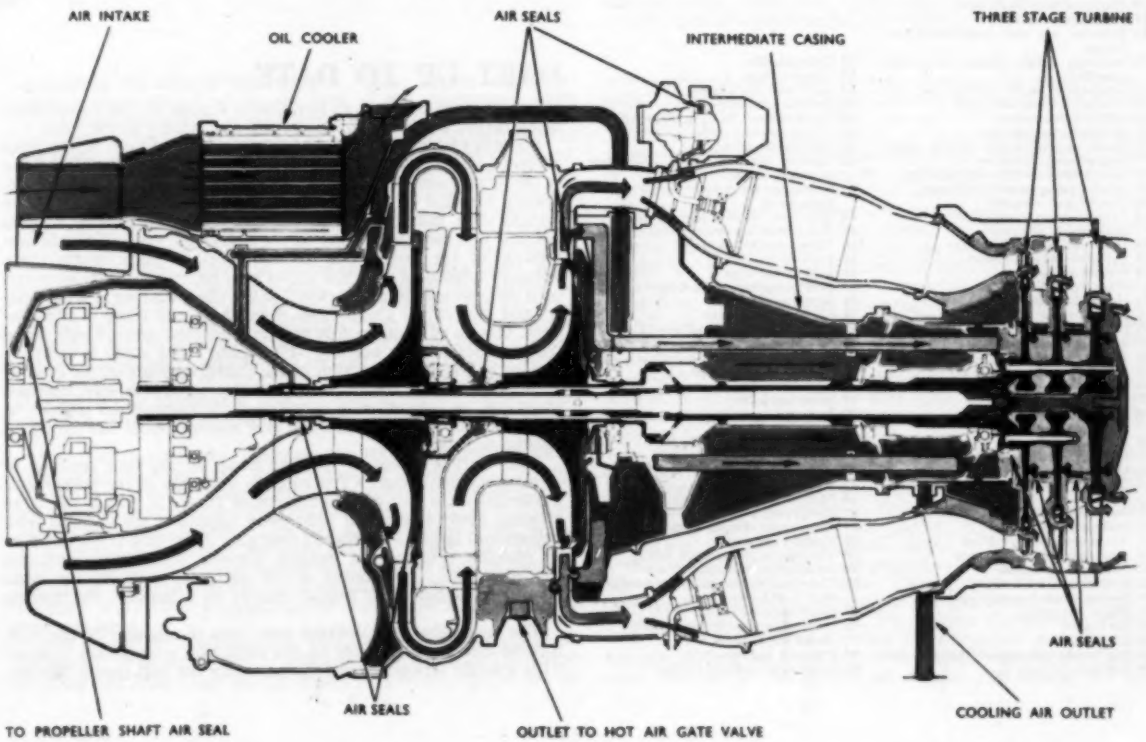
The nozzle box and first two turbine stages of the RDa.7 are substantially similar to those of earlier Darts, but the increased combustion temperature and higher gas-stream energy resulting from the additional mass-flow necessitated the additional turbine stage. An immediate result has been a reduction in the loading per stage and an overall increase in component efficiency of the turbine as a whole. The first two turbine stages carry the triple-tip seals introduced in the two-stage turbine of the Dart 510, and changes have also been made to the blade material. The two-stage engines used Nimonic 80A high- and low-pressure-stage turbine blades (although Nimonic 90 blades have been introduced on the first H.P. stage) and the new turbine uses Nimonic 95 on the H.P. stage blades, 90 on the I.P. stage and 80A on the L.P. stage.

With the additional turbine disc the method of attachment to the mainshaft assembly has been changed. Where a central locking nut was previously used, there are now ten tapered-shank bolts locating the discs radially; five pass through the H.P. and I.P. discs and a further five run through all three discs, which overhang from the drive-shaft flanges and abut against the mating faces of the bolt bosses.

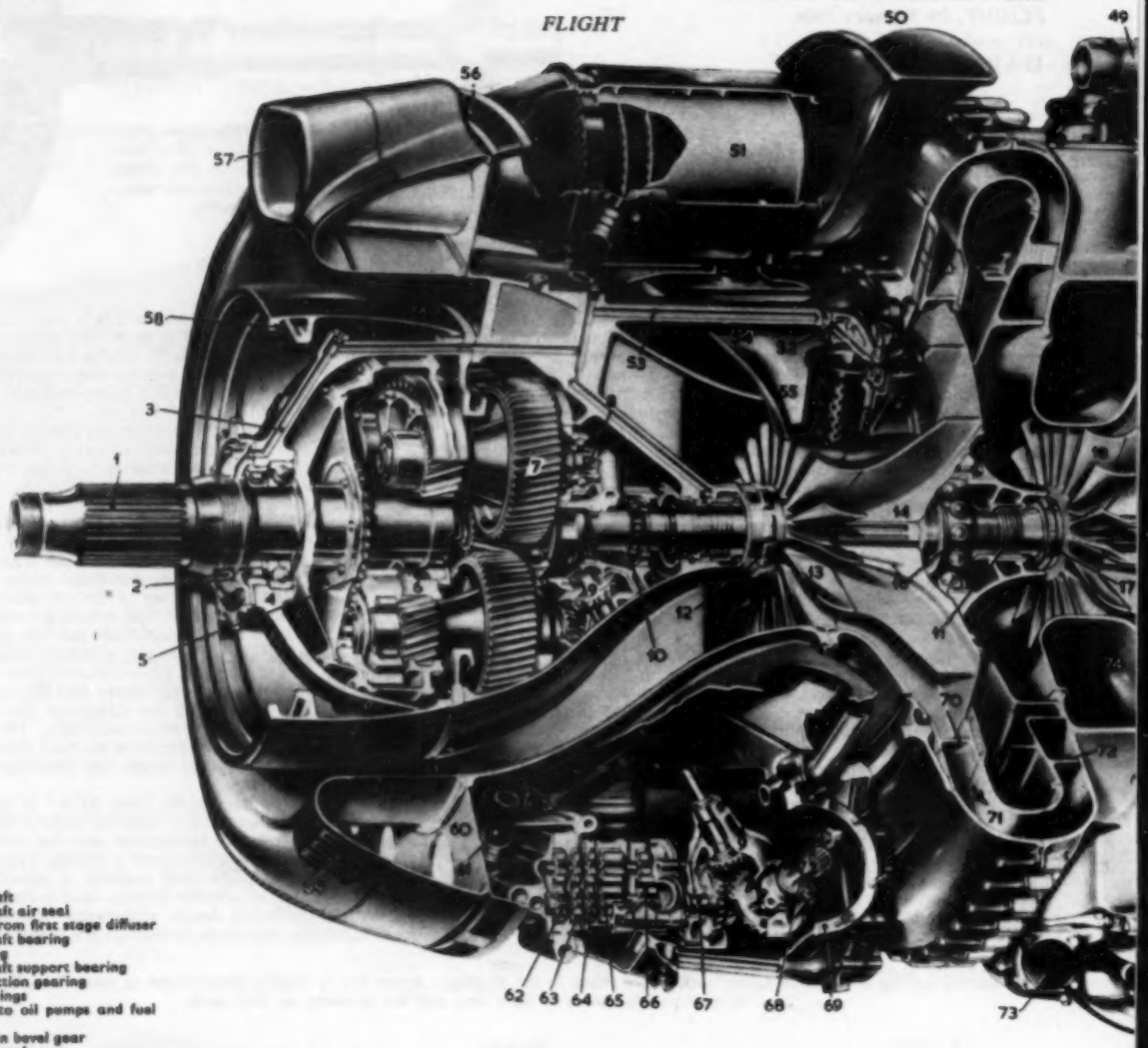
Both high-pressure air tapped from the second-stage compressor and low-pressure air from the intermediate casing is used for turbine cooling. High-pressure air is ducted into the annular space on the front face of the H.P. disc, where it is separated from L.P. air by a labyrinth seal carried from the ten disc-mounting bolts. A second labyrinth seal permits a limited airflow outwards across the front face of this disc, while the remainder passes along the annulus between the interstage sleeve and the central bore of H.P. and L.P. discs for cooling the interstage disc faces before joining the main gas-flow at the blade platforms. The near face of the L.P. disc is cooled by low-pressure air bled through holes in the drive shafting and ducted along the interstage cooling-air sleeve.

Another feature unique to the Dart RDa.7 is that the drive shafts have been divided, so that from the turbine there are quite separate shafts driving the compressor and the reduction gears. Although this change must represent a certain weight penalty in comparison with the single-shaft engines, it provides a second stage of defence against possible failure—and is therefore directly in line with Rolls-Royce design philosophy. In the event of a failure of sufficient magnitude to fracture the reduction-gear shaft,

Combustion, cooling and pressurization airflows are shown in this diagram. Arrow size is roughly proportional to mass flow; high-pressure air is indicated by means of light tone and low pressure air with dark.



TWO STAGE CENTRIFUGAL COMPRESSOR



1 Propeller shaft
2 Propeller shaft air seal
3 Sealing air from first stage diffuser
4 Propeller shaft bearing
5 Stiffening ring
6 Propeller shaft support bearing
7 Helical reduction gearing
8 Carrier bearings
9 Bevel drive to oil pumps and fuel pump
10 Starter-driven bevel gear
11 Thread-type seal
12 Impeller nut and water-methanol flinger
13 Rotating guide vanes—first-stage impeller
14 Compressor shaft—first stage
15 First-stage impeller rotor
16 Interstage bearing
17 Impeller securing nut
18 Rotating guide vanes—second stage
19 Second-stage impeller
20 Compressor shaft—second stage
21 Second-stage impeller air seal
22 Centrifugal breather
23 Second-stage impeller drive shaft coupling
24 Drive shaft-reduction gear
25 Drive shaft-compressor
26 Helical splines
27 Plain bearing
28 Drive shaft air seal
29 Reduction gear drive shaft seal
30 L.P. turbine disc cooling air
31 Turbine bearing
32 Turbine interstage air sleeve
33 L.P. disc securing bolts (5)
34 H.P. turbine air seals
35 I.P. turbine air seals
36 L.P. turbine air seals
37 H.P. nozzle guide vanes
38 H.P. turbine
39 I.P. nozzle guide vanes
40 I.P. turbine
41 L.P. nozzle guide vanes
42 L.P. turbine
43 Rear slinging eye
44 Inner cone tie-bolt
45 Accessory gearbox drive
46 Accessory drive spur gear
47 Fireproof bulkhead
48 Rubber sealing strip
49 Engine mounting tube socket
50 Warm air outlet
51 Oil cooler
52 Oil filler cap
53 Pressure to compressor front bearing
54 Annular oil tank
55 Oil tank filter
56 Cowling land
57 Oil cooler air intake
58 Spinner extension
59 Cyclic-heated de-icing elements
60 Intake cowling baffle
61 Oil supply stand pipe
62 Centre bearing and wheelcase scavenge pump
63 Interstage compressor bearing scavenge pump
64 Rear bearing scavenge pump
65 Main sump scavenge pump
66 Main pressure pump
67 Pump drive shaft
68 Fuel pump drive
69 Fuel pump mounting face
70 First-stage diffuser
71 First-stage air flow
72 Compressor intermediate casting
73 Hot air gate valve
74 Second-stage pressure-balance air
75 Second-stage diffuser
76 Fuel drain valve
77 Spherical joint
78 Burner
79 Inner flare
80 Flame tube suspension pin
81 Cooling rings
82 Interconnector
83 Flame tube
84 Flame tube rear section
85 Air casing
86 Piston-type sealing ring
87 Cooling air outlet
88 Thermocouple junction box
89 Nozzle box mounting drum
90 Thermocouple in intermediate N.G.V. (12 off)
91 Inner exhaust cone
92 Inner cone securing set screws
93 Outer exhaust cone
94 Pressure balance hole
95 Inner cone support fairing

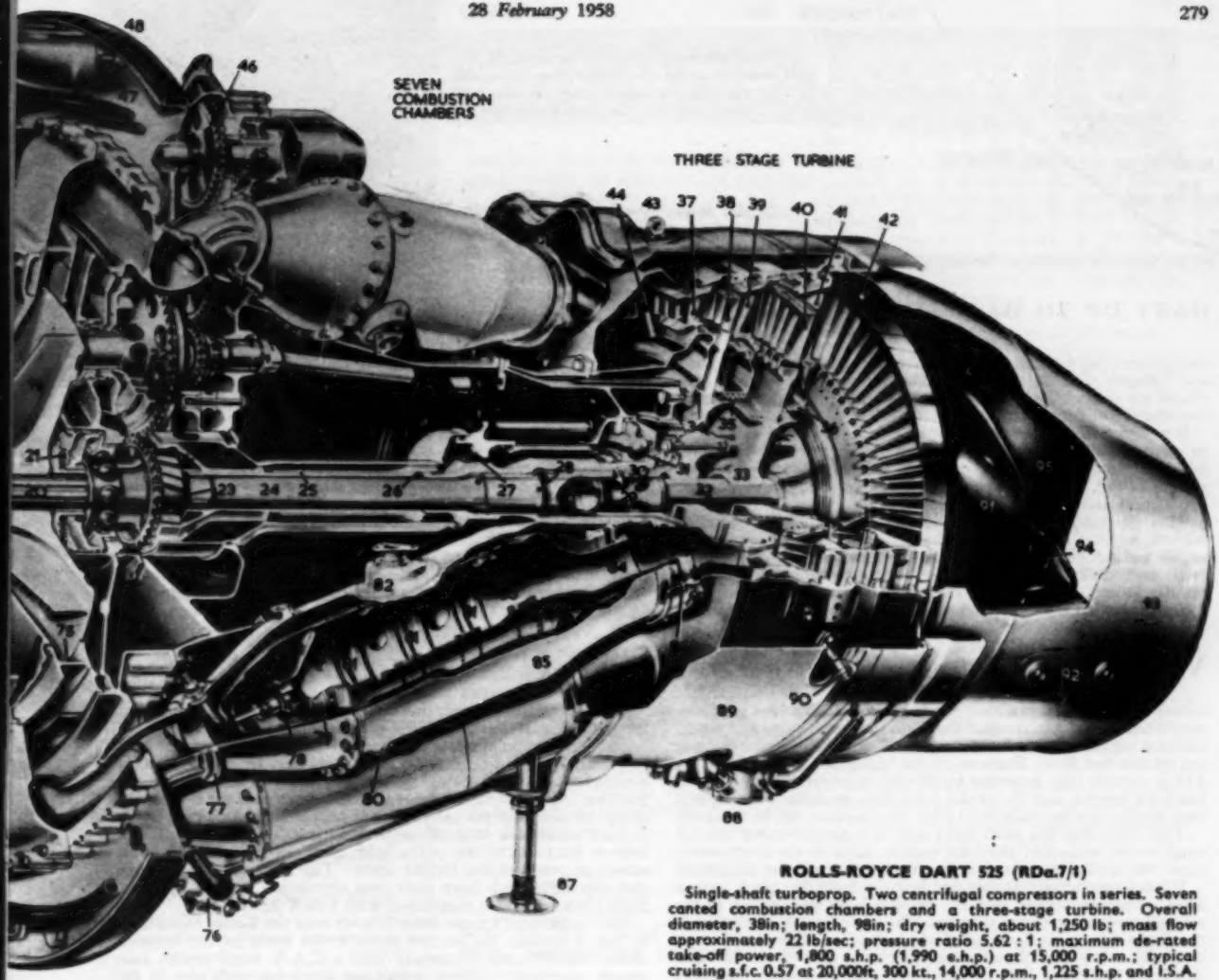
DART UP TO DATE . . .

the engine can continue to function as a pure jet, the compressor being driven from the turbine by the stiff outer-turbine shaft.

Flanges formed at the extreme after ends of both shafts abut against a rim on the front face of the H.P. turbine disc. The drive is taken through the ten bolts securing the three discs. Immediately forward of this coupling flange, the compressor drive (outer) shaft is carried in a ball thrust bearing and by a plain bearing in a housing mounted on a pierced vertical diaphragm forward of the nozzle box mounting-drum. Both bearings are pressure lubricated, the ball thrust bearing by an oil jet protected by a thread-type filter. Forward of the plain bearing is a helically splined joint in the compressor drive shaft, and there is a similar joint, though of considerably greater diameter, immediately aft of the compressor rear bearing. The spline helix angle is carefully chosen to adjust the reaction of the thrust throughout the engine. Although the nett thrust cannot be altered in this way, reaction loads can be conveniently distributed throughout the engine; in any case the main compressor and turbine loads are balanced against each other.

Two further stages of shafting make up the four sections of compressor drive shaft. The rotating assembly of the compressor is carried on a two-piece compressor shaft, to which the steel rotating guide vanes and light alloy impellers are secured with splines and large C-spannered ring nuts. The first-stage impeller is phenolic-resin-coated against erosion and water/methanol contamination. The halves of the compressor shafts are again coupled together with helical splines to minimize the bearing thrust loads.

The reduction-gear shafting runs from the flanges on the H.P. turbine disc to the splines on the reduction gear pinion tailshaft with a single straight-splined joint under the ball thrust bearing,



ROLLS-ROYCE DART 525 (RDa.7/1)

Single-shaft turboprop. Two centrifugal compressors in series. Seven canted combustion chambers and a three-stage turbine. Overall diameter, 38in; length, 98in; dry weight, about 1,250 lb; mass flow approximately 22 lb/sec; pressure ratio 5.62 : 1; maximum de-rated take-off power, 1,800 s.h.p. (1,990 e.h.p.) at 15,000 r.p.m.; typical cruising s.f.c. 0.57 at 20,000ft, 300 kt., 14,000 r.p.m., 1,225 s.h.p. and I.S.A.

supporting the second-stage impeller. Plain bushes to prevent fretting are provided within the bore of the compressor shaft; one behind the helical splines forward of the compressor shaft plain bearing and a further bush in the compressor shaft bore at a position in line with the front of the seven expansion chambers.

Very few changes between the Dart 510 and 525 can be directly ascribed to the increased rotational inertia of the compressor/turbine assembly. The bearings are all basically the same and only the oil flow has been slightly increased. Because of limitations in the existing torquemeter arrangement, the tooth angles of the high- and low-speed reduction gear trains have been designed to preserve the total axial thrust along the layshaft at the same value as before. The gears themselves have been increased in width to absorb the additional power to be transmitted.

Engine starting is by an 11 b.h.p. compound-wound 28V Rotax motor, torque being transmitted thriugh a spring-loaded multi-plate clutch and an inclined shaft to bevel gearing driving the tailshaft of the high-speed pinion. A centrifugally loaded pawl engaging mechanism is incorporated on the shaft to take up the drive.

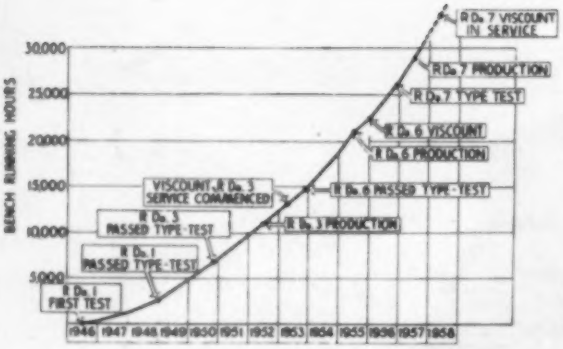
One final detail change completes the RDa.7 picture. With the three-stage turbine, the gas-temperature pyrometer thermocouples (six or twelve may be fitted) are arranged radially around the nozzle box to protrude into the gas stream at the intermediate turbine stage where they are located in the hollow guide vanes. It is necessary to sample temperature at a number of different points well distributed over a cross-section of the flow, as zones of dissimilar temperatures can exist simultaneously; this was particularly true when jet-pipe, rather than turbine, temperature was measured.

The first RDa.7 engine ran in July 1956 and was immediately successful. It passed its 150 hr type-test when less than 250 hours' running had been done on the engine as a whole; and a 200 hr test at take-off flame temperatures covering the whole range of engine speeds from 14,500 to 15,500 was successful also—particularly when it is borne in mind that the 150 hr test requires only 18½ hr at take-off rating. Since the first run, over 4,100 hr of development testing have been carried out, including test flying in a DC-3 and tropical trials in Vickers' prototype Viscount 806/810. It is hoped rapidly to establish an overhaul life of 1,500 hr, in line with previous Dart experience.

It is natural perhaps to look forward at this time to the next stage of Dart development. And already the first RDa.11 (Mk 541) engine for bench running will soon be delivered. More powerful, with more jet thrust and an increase of a further 16 per cent in mass flow, the RDa.11 is altogether a bigger engine than the RDa.7, yet the maximum diameter of cowling required to accommodate it remains unchanged. Take-off power of the fully rated engine, the RDa.10 (previously the RDa.8) is 2,400 s.h.p. at sea level with a limiting flame temperature of 1,225 deg K, but the RDa.11 is de-rated at take-off and gives 2,100 s.h.p. at sea level I.S.A. and limiting flame-temperature is not reached until I.S.A. +14 deg C.

In order to obtain the additional mass flow, the intake cross-sectional area has been increased, and the nose cowl is bigger; RDa.11 engines will also be fitted with a larger, pointed spinner to increase air-intake efficiency. Rotol trapezoidal blade-form propellers will again be used, but modified to accept the increased torque and a No. 4½ size propeller shaft.

Within the larger intake are reduction gears of increased capacity on wider layshaft centres. The eye area to the first-stage rotating guide vane is increased so that the inlet velocity will be similar to that of the RDa.7. To increase the pressure ratio to 6.35 : 1 the diameter of the first stage impeller rotor has been brought up to 21in. But the overall through velocity remains constant, because of the greater air density and almost the same



(Left) No better idea can be given of the steady progress of the Dart than this graph of development hours from the earliest engine to the RDa.7—and beyond.

(Right) Blades for the three-stage turbine —this is one from the high-pressure stage —follow the familiar pattern, with extended blade roots and tip seals.

DART UP TO DATE . . .

components can be used for the combustion chambers, nozzle box and turbine. The latter is rebladed, however, as cooled turbine blades are now essential; the air tapped from the H.P. diffuser to cool the turbine discs is used.

It now remains for development testing of the engine as a whole to round-off the component, rig and development testing that has already been under way for some time. A similar programme to that of the RDa.7 will be followed, and the engine is due for production delivery in 1960.

This description of Dart development would be incomplete without another look at the service record which this remarkable engine has achieved. Some 140,000 Dart hours are being accumulated each month, so that experience is now being gained very rapidly indeed. Several Dart carcases have reached lives of over 5,000 hr, but so also have some gearing components and turbine blades, and 25 turbine blade sets have reached 4,000 hr or over and 20 discs between 3,500 and 4,000 hr.

Because of the pioneering nature of the Dart, Rolls-Royce follow a policy of hangar-testing to a simulated flight schedule components that have achieved long lives in order, if possible, to keep 1,000 hr ahead on the development of the more critical components. They have run a pair of turbine discs to 6,750 hr. It is not always realized that operational failures tend to increase after initial operations, simply because overhaul lives are constantly extending. The lessons to be learned are that modifications may take a long time before incorporation and that any snag that does arise requires a very extensive organization to correct.

One final figure: for routine maintenance and scheduled and unscheduled engine changes over a 1,400 hr overhaul life (including the powerplant build) the average maintenance time is now seven man minutes per flying hour. But perhaps the best recommendation for the Dart is contained in the daily inspection instruction of its own service manual: check oil level, turn, listen, look.

VISCOUNT 810 (continued from page 273)

failure occur, or the constant speed governor stick, the propeller would fine-off until it reached the flight fine pitch stop, and would increase r.p.m. in this finer pitch until the overspeed governor cut off the fuel flow. Even so, at the higher speeds of which the 810 is capable, the propeller could still windmill fast enough to burst the engine, and the cruise pitch lock provides a mechanical stop which must be unlatched before the propeller can be fined-off.

The cruise and fine pitch locks may be regarded rather like the stops on an umbrella: they are passive stops in the limit conditions but require a positive action before they can be unlatched.

It can be seen from the diagram how the flight fine pitch control lever is interconnected with the throttle lever and moves to the take-off position with the throttle. The lever operates switches in the flight fine pitch lock-withdrawal circuit and on an electro-hydraulic safety stop circuit, to ensure that at take-off and in flight the flight fine pitch lock is secure and that an electro-hydraulic safety stop (as fitted also to the propeller of the Dart 510) is in operation as a safeguard against flight fine pitch-lock failure.

Instruments. The instrument panel layout is much the same as before, except that the 812 is equipped with American instruments. A distinctive feature of Continental aircraft is that the R.C.A. Type AVQ-10 weather radar scope is mounted in the centre of the engine panel, so that there is a corresponding slight re-arrangement of these instruments; the torquemeters have been dualed for pairs of engines so that some of the direct "up and down" scanning of the engine instruments has been lost—but pilot reaction is reported to be favourable. The circuit breaker panel is now included on the starboard console in reach of the second pilot. The 812 is equipped for two-crew operation with a central jump seat and—as in all U.S.-operated aircraft—demand-type oxygen and smoke masks are provided for the crew. These incorporate built-in microphones giving full inter-communication facilities when smoke masks are worn.

Electrical System. Growing demands for more electrical power —a bigger galley, extra radio, weather radar and provision for optional equipment—has been met by replacing the earlier 6kW generators with four 9kW machines, A.C. being supplied (on the 812) by two 3kVA Jack and Heinz inverters. Cooling of the larger generators on the ground is by means of a jet pump, actuated by air bled from the engine compressor, in the generator exhaust ducting. The pump is switched off at take-off and the generators are then ram-air cooled; full generator output is hence available both on the ground and in the air.

Air Conditioning. Although the cabin differential pressure remains at 6.5 lb/sq in, the pressurization and refrigeration capacity have been increased quite substantially. The cabin-air blower speed has been increased by about ten per cent in the cruise condition and air, controlled and supplied by AiResearch equipment, may be provided at up to 11 lb/sq in. Provision is made on the 810 for water separation and for Janitrol heaters in the lower fuselage aft of the wing, although neither system is specified by Continental.

Cabin ventilation air in the 810 installation is introduced from the central roof duct, at eight points adjacent to the overhead lights. Ventilation systems are always something of a compromise, and what is gained on the cooling swings may be lost on heating roundabouts, but the revised system is in line with the best modern practice. Air is exhausted through exit louvres near the floor space along the length of the cabin. In the forward cabin a single outlet is used which can shut off cabin discharge air from the freight hold in the event of fire in the hold; normally this used cabin-air serves to ventilate the freight space. The rear passenger lounge and the flight deck have their own circulation systems, and the flight-deck heating is augmented with a 3kW heater.

On Continental's route from Denver over the Rocky Mountains to San Francisco, the aircraft must fly for some twenty minutes above 16,000ft and, to comply with a C.A.A. requirement, passenger emergency oxygen points are fitted for each seat in the cabin. Oxygen is drawn from a 1,800-litre bottle.

Payload Accommodation. The work of design consultant Charles Butler, the interior *décor* of the 812 is one of the most pleasing yet seen in a Viscount. Continental's aircraft is arranged for a total of 56 seats; eight in the forward cabin arranged four abreast with a central ailse, 44 in 11 rows in the main cabin and four in the rear lounge aft of the galley.

For other customers the rear lounge can be replaced by an additional freight or baggage compartment with a separate freight door, but Continental prefer to have a carry-on luggage rack adjacent to the forward entrance door and a wardrobe aft.

A measure of the consultant's ability is the manner in which 13 different shades of blue, brown and rose-coloured Vynides, two chair coverings, two curtainings and floor coverings and five different colours of metal or plastic trim are blended into a harmonious interior colour scheme—with "antique-type" mirrors (with a slightly dulled reflecting surface) on the bulkhead walls.

Early in 1956 Vickers carried out tests—notably noise trials—on the Viscount 700 prototype G-AMAV at representative Viscount 840 speeds and both they and Rolls-Royce are accumulating flying hours on the Dart 525; Vickers on the prototype 810 and Continental's first aircraft, and Rolls-Royce in a DC-3. Another aircraft, an 806 equipped with RDa.7 (Mk 520) engines is completing tropical trials in Africa. Both the prototype 810 and the first aeroplane for Continental are now based at Wisley and engaged upon an intensive certification programme prior to delivery of the first aircraft.

VISCOUNT 812

Four Rolls-Royce Dart 525 turboprops of 1,750 s.h.p. for take-off

Dimensions: Span, 93ft 11in; length, 85ft 8in; height, 26ft 9in; gross wing area, 963 sq ft.

Weights: Maximum take-off, 67,500 lb; maximum landing weight, 60,000 lb; zero fuel weight, 54,400 lb; aircraft empty weight, 40,810 lb; maximum payload, 12,510 lb.

Guaranteed Performance: Cruising speed at 20,000ft, I.S.A., and at 60,000 lb weight, 354 m.p.h. T.A.S. Corresponding fuel consumption, 3,050 lb/hr. Take-off distance to 50ft or accelerate-stop at 67,500 lb, sea level and I.S.A., 5,500ft.

Straight and Level

THE president of the U.S. Air Transport Association, Stuart G. Tipton, has at last got approval from the Civil Aeronautics Board for a six per cent (or thereabouts) fare increase. Seven of his domestic airline-members asked for this last year. The ensuing pother is a long, long story; but what is Mr. Tipton's reaction to the granting of his members' original request? "Absolutely not sufficient," he growls.

Come, come, Mr. Tipton—is this not a little churlish? Is it not unwise to antagonize those who hold you so tightly in their power?

And, by the way, is it not economic nonsense to say that refusal of a further fares-boost "will tend to stifle and slow down drastically the remarkable growth of the industry"? I thought that price *reductions* increased traffic growth.

But I must admit that it is all very well for me to admonish the U.S. air transport industry. Their commercial efficiency—take any index you like—puts the State-owned airlines of the Old World to shame. Even if the U.S. domestic airlines get a 15 per cent fare increase, which is what they now want, their fares will still be hardly more than a half of intra-European airline fares.

● *First Principle No. 1:* Every British aircraft manufacturer would like to see his factories humming with commercial airliner production.

F.P. No. 2: The extent to which his factories are full will depend directly upon the future public demand for air travel.

F.P. No. 3: The future demand for air travel will depend directly upon the cost of tickets, and upon little else that really matters.

F.P. No. 4: The price of the ticket is the only, repeat *only*, key to the sluice-gates of mass air travel.

F.P. No. 5: Mass air travel will bring prosperity to the airlines and to the manufacturers who supply them.

If it is all as simple as this, why are not the efforts of every British manufacturer, and of each airline Corporation, directed towards cheaper fares? By all means let us cater for the first-class traveller: but is he the chap who is going to fill our civil aircraft factories in the future?

● One type of research facility which American experience has shown to be invaluable is the precision-laid railed track upon which supersonic test sleds can run. These tracks have already helped no end in the development of missile guidance systems, aeroplane crew-escape mechanisms, the proving of components of all types against high and sustained acceleration, the perfection of surfaces intended to resist rain-erosion at Mach 2, and lots of other fields in which a large (full-scale) device has to be shoved through "free-stream" air at high supersonic speed.

Biggest of the tracks is at the U.S.A.F. Air Research and Development Command base at Holloman, New Mexico; when extended to 35,000ft (almost seven miles) it will run the largest vehicles up to Mach 4. A similar speed can be reached on the 20,000ft track at Edwards A.F.B. Over 2,180 m.p.h. has been achieved on the Navy's 21,500ft SNORT track at China Lake, and other major efforts include the terrifying Coleman track at Hurricane Mesa, which runs for 12,500ft to the sheer edge of a 1,500ft precipice over which escape capsules can be fired. All these tracks cost money, and America has found good reason to build at least a dozen. How many do we have? (Echo answers: Maybe none at present. I wouldn't know what's been built at Woomera, but I'll bet ejection-boots we have a good one inside five years. And this will be ten years too late.)

● *"Out of deep freeze comes an Otter . . like other equipment, it was kept under snow for a year, until it could be used . . ."*

That was the caption which the U.S. *Air Force Times* gave to the picture which I reproduce here—with acknowledgements to that journal, and to M/Sgt. Jack Little who took the photograph.

The Otter is one of many used in the Antarctic by the U.S. Air Force and Navy in "Operation Deepfreeze." I don't know what D.H. Canada's service department would say about this storage practice, which I should have thought much too considerate for the Otter. Didn't someone once say that it is an aeroplane "designed for the sort of pilot who comes into town once a year for a daily inspection and a shave?"

The Neptune propeller, incidentally, was used as a marker.

● One of the things most important to British aviation is the Vickers-Armstrongs Viscount, and one of the most important factors affecting the future Viscount sales picture is the tremendous fact that this aeroplane can be made to cruise, efficiently and reliably, at 400 m.p.h. This is quite fortuitous, and Sir George Edwards himself was recently heard to wonder just who was looking over his shoulder when he and Rex Pierson were laying out the Viscount wing more than a decade ago.

● *Lord Brabazon in 1946:* "For almost a decade we have had to bend all our energies to the production of military aircraft. This leaves us with much leeway to make up if we are to catch America in the field of civil airliners."

Mr. Carl Hinshaw, member of the U.S. House of Representatives, speaking ten years later on the Korean war: "we were doing our best and producing all the military aircraft, even though the Soviets were practically on the borders. They [the British] were building jet commercial aircraft for the purpose of recapturing the transportation market in British-built aircraft. Our people have been so busy making fighting planes they have not had time to build transports of modern design."

● Coming from Armstrong Siddeley one day I made the acquaintance of a battery of large portions of vitreous glazed china on Coventry station, and was interested to note that each bore the trade mark "Sapphire". Even in my own office here all the wash-basins are called "Tyne". It just goes to show that you can't think of a new name; but I'm willing to bet there is only one thing designated J57-P-35W—so there may be something in algebraic symbols after all.

ROGER BACON

PAKISTAN AIR FORCE

Part II

By HUMPHREY WYNN

The Commonwealth's Youngest Air Arm

AN invitation was recently extended by the Pakistan Air Force to "Flight" to see its facilities and study its operations. Part I of this article was published last week and the staff member to whom the assignment was given concludes his impressions in these pages.

OUR first flight—one of 3½ hours from Mauripur to Miram Shah—took us over the magnificent Sukkur Barrage, which controls the waters of the great Indus on its long journey from Kashmir to the Sind desert. At Miram Shah, we were in a world totally different from the humid metropolitan atmosphere of Karachi: here the air was clear and sweet, in a world of dry brown mountains lifting towards the Afghanistan border which at its nearest point is only 12 miles away.

As soon as we landed, five Furies of No. 9 Squadron took off to give a rocket-firing demonstration against a target on the airfield, which is 3,070ft above sea level. They rounded off their ground attacks with two formation loops, the aircraft looking magnificently picturesque against the high white clouds and tawny mountains.

No. 9 Sqn. is based at Kohat and keeps only two aircraft on detachment at Miram Shah, where at night they are housed inside the fort in small hangars once used to take the R.A.F.'s Harts and Audaxes and now slightly enlarged for their present-day occupants.

The fort itself, with its square mud walls and lookout posts, is a fascinating and historic place. Built in 1905, it is still—as in those more troubled pre-war times—completely self-contained, water wells and all domestic buildings being within the compass of its walls. The only exception to this fortified enclosure is a sports stadium built in 1957 by the Tochi Scouts, who as part of the Frontier Corps (whose headquarters is at Peshawar) man the fort. They are Pathans, and one of the excitements of a visit to Miram Shah is to watch them perform some of their infinitely varied and potentially endless tribal dances in the stadium.

In pre-war days, the R.A.F. used to keep a squadron at Miram Shah; as did the P.A.F. until recently it reduced its force to a detachment from No. 9 Squadron, whose chief function is to undertake police actions on the border if help is asked for by police or civil authorities. The last one was carried out about two years ago. Over a door of the squadron crew room at Kohat is a notice which would ring familiarly in the ears of pre-war R.A.F. pilots once stationed there, for it says: "Our aim is to defend the North-West Frontier."

The squadron, which is commanded by S/L. Zulifiqar and has a red dragon as its badge, is one of the oldest in the P.A.F. since with Nos. 5 and 6 it was one of the three units to come over from the I.A.F. in 1947 as the nucleus of the new air force. It is now the only P.A.F. fighter squadron to be equipped with piston-engined aircraft, and had the honour in 1951 of forming the first P.A.F. formation aerobatic team. The precision with which the formation loops were performed at Miram Shah (and, the following day, at Kohat) seemed to prove that the squadron's new members have inherited their predecessors' skill.

Kohat is a blending of the former R.A.F. station with new P.A.F. buildings, for as well as being a squadron base and storing Bristol Freighters in its hangars, its chief ground function is to house the P.A.F. Recruits' Training School. At the station there is also a non-technical training school (as opposed to the technical centres like the Apprentices' School at Korangi Creek and the School of Electronics at Malir) and an M.T. training school; a course in administration for officers is run there; and the Inter-Services selection board for officers is also at the station.

There are about 1,100 airmen in the recruits' training school, some of whom must have had long journeys from distant parts of the country to reach there. For example it is about 700 miles from Karachi, and recruits coming from East Pakistan have had over a thousand miles to travel. (All P.A.F. journeys between East and West wings of the country are made by air.) The recruits' training contains a large amount of drill and P.T., with plenty of organized games; and in the healthy atmosphere of Kohat—which is removed from any metropolitan distractions—they get a good introduction to P.A.F. life.

There are up to 150 students in the non-technical training school; about 85 airmen are receiving M.T. training (though their number fluctuates); and about ten officers at a time attend the administration course. Altogether Kohat houses approximately 2,500 personnel, in addition to a large number of civilians. Commanded by G/C. M. M. Paracha, it is a historic (started by the R.A.F. in 1924) and beautiful spot, with a fine climate and plentiful vegetation. One of the treasures of its Officers' Mess is a salt-cellar inscribed as having been presented by "F/L. B. E. Embrey."

Flying from Kohat south-eastwards to Lahore, one passes quickly from the brisk dry frontier world of Yeats-Browns' Bengal Lancer to the busy metropolis of Kipling's Kim, ancient seat of the Moghul emperors and capital of the Punjab. At Lahore airfield (the civil airport is at Walton, a few miles away) the P.A.F. has its transport aircraft headquarters. No. 6 Squadron, like No. 9 one of the "old originals" and now equipped with Mk 31 Bristol Freighters, is based there and so is No. 3 (Transport Conversion) Squadron which has six Mk 21s. The organization of the station, with its flying, technical and administrative wings, is much the same as at R.A.F. stations; and the officer commanding (W/C. S. I. R. Bokhari) is directly responsible to the A.O.C. of No. 1 Group at Peshawar. Other units on the station include the Central Medical Board, a Provost branch and a wing of the Shahin A.T.C. with three gliders—a Sedbergh, Grunau Baby and an Olympia.

"Flight" photograph

P.A.F. Kohat from the airfield control tower, showing Hawker Furies (left foreground), Bristol Freighters and—in the background—the station buildings, dominated by the Training School.

No. 6 Squadron, whose flying task is 800 hr per month, draws its pilots either from the P.A.F. College at Risalpur or from the fighter squadrons, via No. 3 T.C.S. Its rôle was succinctly defined by the C.O., W/C. M. I. Rahman, as that of flying "anything from a V.I.P. to a flour-bag—anywhere in Pakistan or elsewhere." This rôle is fulfilled in several ways:—straightforward transport duties in West Pakistan, and between the West and East wings of the country; supply-dropping to Army units in Kashmir (from April to October a detachment is maintained at Chaklala for operations into the Gilgit area); flood relief in E. Pakistan and also (though less regularly) in W. Pakistan; runs to the U.K. and Australia for training or supplies and when other commitments permit; and odd special duties such as transporting U.K. aviation journalists visiting the P.A.F. During 1955, the squadron flew 146 sorties (343 hr) on W. Pakistan flood relief; and in 1956 it flew 108 sorties (219 hr) on similar duties in E. Pakistan. The squadron also has its own training flight, which gives 6 or 7 hours' training a month to "A" and "B" category crew members and 8 to 10 hours to the lower categories. (Every crew member on the squadron must have a category: there is at present one "A" pilot—the C.O. —and one "A" signaller; there are four "B" pilots, two "B" navigators and three "B" signallers. After pilots have reached "C" standard it is left to them to improve their category.)

The transport conversion squadron at Lahore, with an average of eight pilots, navigators and signallers on each course and two courses a year, aims to bring incoming crews up to "D" category or an equivalent standard. Some pilots come to Lahore by direct entry from Risalpur and do not have sufficient flying experience for a "D" category, though they may prove to have the requisite ability. When they go on to No. 6 Squadron they must in six months achieve a "D"; then within a year and in two attempts have to improve this category to "C."

Categorization is thus a key word at Lahore, and the syllabus and method of tuition employed is basically the same as that in the R.A.F. Three years ago the Transport Command categorization team visited the station, and subsequently four crews from the squadron went to Dishforth for categorization there. The P.A.F.'s equivalent of the T.C. team—the Transport Crews Examining Unit, headed by S/L. Z. Butt—now visits Lahore twice a year and categorizes half the squadron on each visit.

The Bristol Freighter is well liked by P.A.F. transport crews, though its lack of speed is felt to be a disadvantage on long hops—especially when flying from East to West Pakistan.

One of No. 6 Squadron's regular and most severe operations is the supplying of Pakistan Army units in Kashmir, and I was able

Viscount 700

Viscount 800

and now The Viscount 810

After the successful world-wide operation of the Viscounts 700 and 800 the New Viscount 810 will also be equipped with DUNLOP tyres, wheels, brakes, Maxaret Anti-skid units, engine intake de-icing equipment and Maxivue windscreen wipers.

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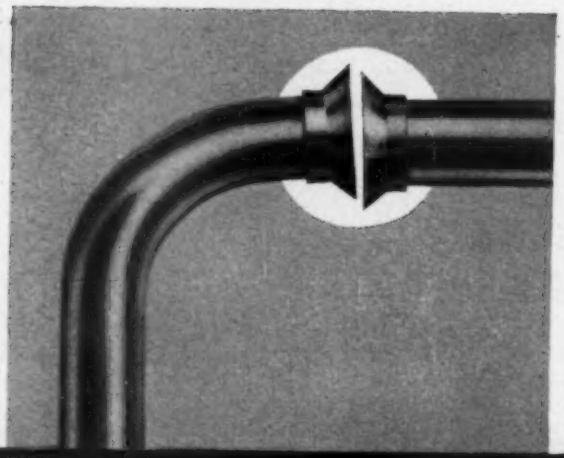
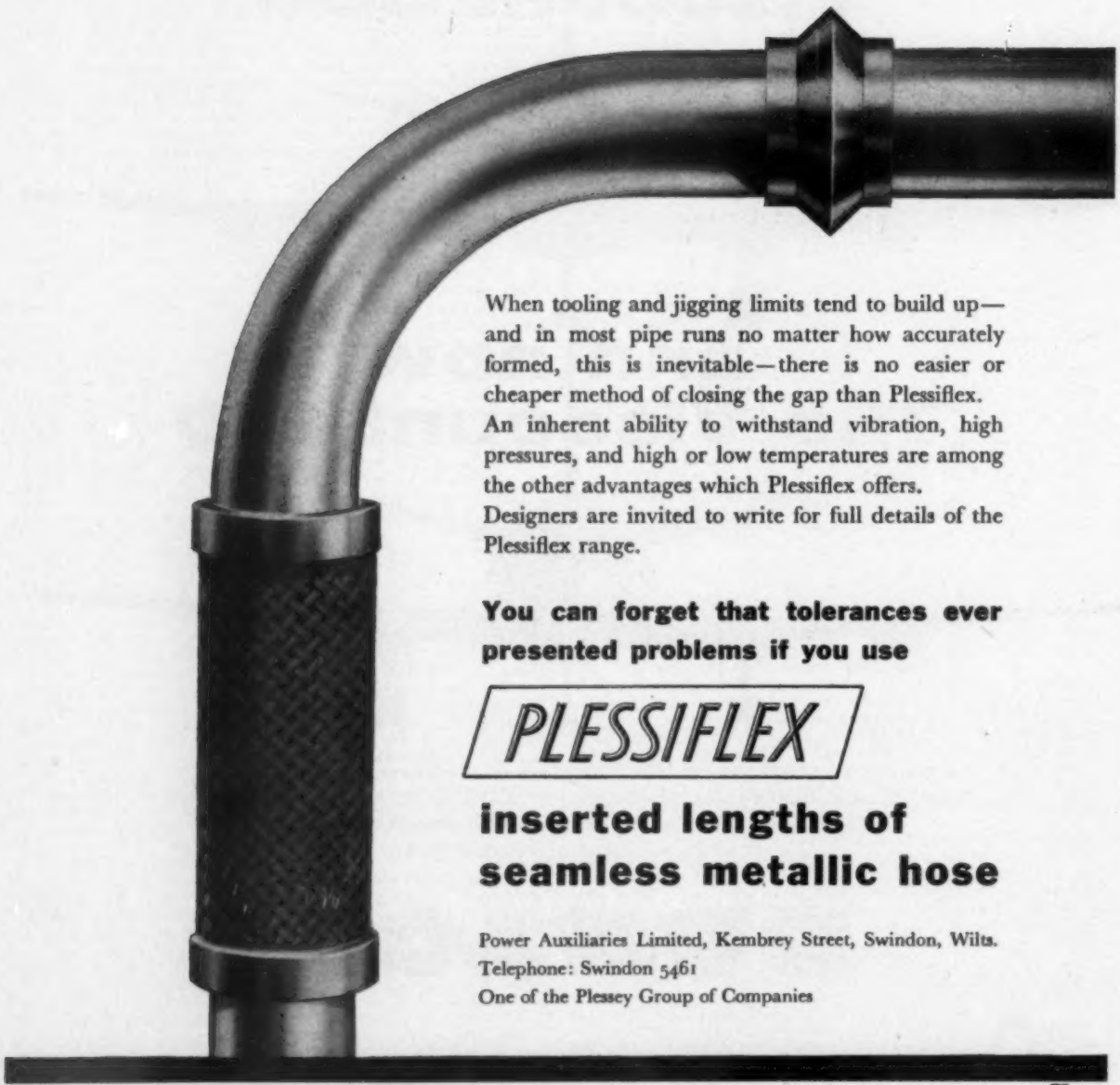
811/606

A question of tolerances?





When tooling and jigging limits tend to build up—and in most pipe runs no matter how accurately formed, this is inevitable—there is no easier or cheaper method of closing the gap than Plessiflex. An inherent ability to withstand vibration, high pressures, and high or low temperatures are among the other advantages which Plessiflex offers. Designers are invited to write for full details of the Plessiflex range.

You can forget that tolerances ever presented problems if you use

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PAL 6

This map shows the location of principal P.A.F. stations and airfields in West Pakistan and Kashmir, and how the two wings of Pakistan are separated by approximately 1,100 miles of Indian territory.

PAKISTAN AIR FORCE . . .

to visualize the difficulties involved when I flew with the squadron to Gilgit and over one of the dropping zones.

Gilgit takes its name from the river which makes a junction with the Indus to the north of Nanga Parbat, the magnificent 26,660ft-high "naked peak." There is an air strip at Gilgit (which Pakistan International Airlines also use with their DC-3s) and in addition to landing there the Freighters carry out supply drops—either free or by parachute—at a D.Z. about 50 miles south-south-east of Gilgit on the Astor River (another tributary of the Indus), and at Skardu, which is east of Astor. To reach Gilgit the Freighters follow the Indus valley, which is both winding and in parts very narrow and is enclosed by mountains rising to heights of 17,000 or 20,000ft. Apart from the terrain, weather is a very severe hazard; mountains have their own atmospheric conditions and these may degenerate suddenly. Yet in some six years of operations—during which for one year (1952) they flew the route by night after I.A.F. Tempests had attacked one of their DC-3s—No. 6 Sqn. has lost only one Freighter.

On this flight to Gilgit the Wayfarer was captained by S/L. Z. Butt, who has about 4,000 hr on Bristol Freighters. We flew north-eastwards from Peshawar to the Indus and then followed its winding course, with the mountains rising ever more steeply on either side until their snow-covered heads were far above our flying altitude of 11,000ft. There was only sporadic cloud that morning, which made the experience a beautiful one for a first flying visit to Kashmir, but of small value as a practical experience of the conditions No. 6 Sqn. have to contend with when the mountains are covered and aircraft have to work their way through the valley, with the ever-present danger of reaching a dead end with no room to manœuvre. Another hazard is the effect of katabatic winds in the ravines, and local pressure variations which affect altimeter readings.

However, meteorological conditions cannot be pre-ordained; and with their prevailing uncertainty we were fortunate even to get to Gilgit during a brief visit to Pakistan. (The Chiefs of Staff of the Baghdad Pact countries' air forces, visiting the P.A.F. at the same time, were not so lucky and could not make the flight to Gilgit.) It was both comfortable and exciting to sit back in the Wayfarer and enjoy this vast and awe-inspiring spectacle of mountains, the least of them twice as high as anything in Europe. The climax was a splendid close-up view of Nanga Parbat, the "naked peak," which that morning was cloudless. One marvelled at the fortitude and endurance of Hermann Buhl, the Austrian mountainer who a few years ago conquered it for the first time—alone and without oxygen.

After rounding Nanga Parbat we flew to the Astor D.Z. and did a simulated dropping run. The zone itself is 7,500ft a.s.l. and parachute drops are done from 500ft above it, free drops from 300ft. Conditions in the summer months can be dangerously bumpy and because such strong winds develop in the Astor valley in the afternoons the deadline for these operations is 1030.

After our simulated run we turned back along the river to its junction with the Indus and thence flew to Gilgit. On the steep hillsides rising to the snow level could be seen narrow tracks with occasional figures of men and donkeys moving along them, hardy people indeed in this mountainous area but blessed by fertile valleys rich with fruit. (Kashmir apples are among the most delicious in the world.) Below us eagles flew, poised menacingly as their keen eyes searched for some prey beneath them.

Gilgit (4,770ft) is a sharp contrast of sandy, stony surface and mountains with snow-covered peaks; the air is blindingly clear and pilots have found that when flying with the blinds drawn back over their cockpits the sunshine can be dangerously strong. There is no room for error at the short landing strip with the river running by it and mountains rising at each end.

Thus Kashmir, with its great mountains and narrow valleys, its hazardous weather and the present military necessity of maintaining airborne supply routes, provides an invaluable operational testing-ground for the P.A.F., whose aircrews have responded courageously and efficiently to its challenge, building up a reputation for successfully taking calculated risks to keep supplies flowing. What sort of pilots and crews these are, and how high are the standards of selection, can be seen by looking at the method of entry to the flying branches of the P.A.F. and the type of education it gives to future officers of No. 6 Sqn. and the fighter squadrons (whose training and work will be discussed later).

In the formative days of the P.A.F., when A.V-M. Atcherley was C-in-C., a wise decision was taken to establish two schools on English public school lines.

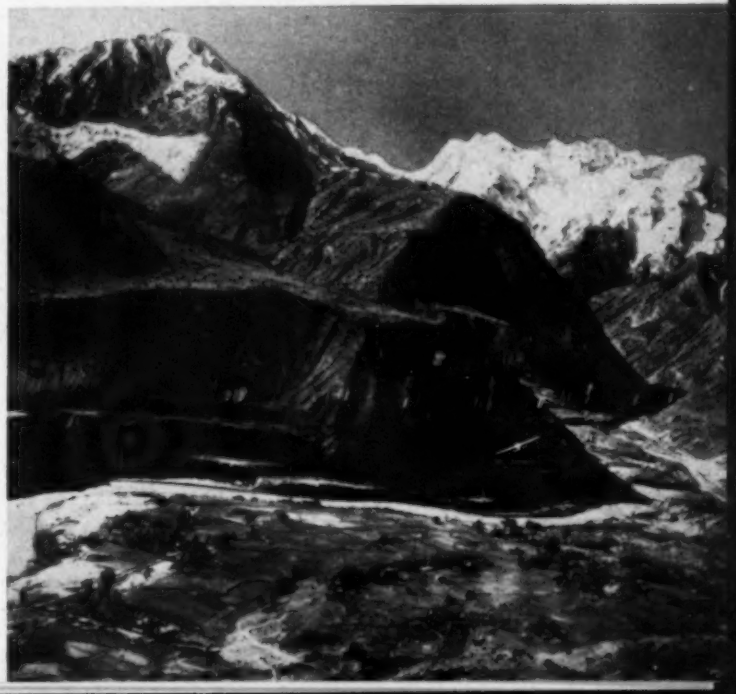
A.V-M. Atcherley was very keen to get more men for the P.A.F. and considered that these schools would develop boys of the right calibre, the idea being first mooted in 1950 and the schools started in March 1953, one at Sargodha in the Punjab and the other at Lower Topa in the Muree Hills (the latter formerly a P.A.F. school of administration but now a pre-cadets school). Air Service Training, Ltd., is still responsible for the schools until the end of this year (as it was once responsible for the Apprentices' School at Korangi Creek), so their principals have at present a dual responsibility to the company and to the Pakistan Ministry of Defence.

At Sargodha, where boys spend six years, their parents pay either no fees at all or varied amounts according to a graduated income scale; and at the end of three years they are asked to declare whether their sons will join the P.A.F. on completing their education. At Lower Topa the boys spend only three years and their parents pay no fees.

Sargodha is very much like a modern English public boarding school (though severe and plain in its architectural pattern), situated well out in the country and surrounded by ample acres of playing-fields. Having tea in the bungalow of one of the assistant English masters, it was hard not to imagine oneself at an English public school. The principal, Mr. H. Catchpole, his deputy, Mr. G. Stott, and several of the staff of 20 are English, the rest Pakistani; in course of time the staff will be all-Pakistani. Certainly the masters take the same interest in boys who have passed through their hands and gone to Risalpur as masters in U.K. do in their protégés' progress at Cranwell or a university.

Entry to Sargodha is by written examination in English, Calculations and General Knowledge, followed by an interview. At the school, the subjects taught are English (a third of the boys come

A Bristol Freighter of No. 6 Sqn., just visible against the dark hillside, dropping supplies at the Astor D.Z. in the northern area of Kashmir.



Cadets at the P.A.F. College at Risalpur (above), dining in their Mess; and on the left, students at No. 2 Fighter Conversion Squadron at Mauripur studying the cockpit of one of their T-33 trainers.

PAKISTAN AIR FORCE . . .

from East Pakistan and their native language is Bengali; the rest from West Pakistan where Urdu is the mother tongue), Mathematics, Science (Physics, Chemistry and Biology), Geography, History, Religious Knowledge, Drawing and Carpentry. In addition, the Air Force aspect of their education is stressed from the beginning, a P.A.F. unit being attached to the school to give lectures and ground training. Elder boys (with their parents' permission) get gliding tuition and some powered flying.

The airfield at Sargodha is a mile or so from the school and a new long runway is in course of construction. Soon, two of the Sabre squadrons at present at Mauripur are to be based there; so boys at the school who may later become pilots will have the incentive of seeing P.A.F. fighter aircraft flying daily above them. As a further help to air-mindedness, the school houses are named after aircraft used (or formerly used) by the P.A.F.—Attacker, Fury, Sabre and Tempest.

It was logical after seeing Sargodha to visit the P.A.F. College at Risalpur, not far east of Peshawar, where boys who have been successful at the school (and whose parents opt for them to join the P.A.F.) go for training as pilots (or navigators) and officers. The college's intake comes from both Sargodha and Lower Topa, and also by direct entry from civilian life and from non-commissioned members of the P.A.F. selected for commissions. It is hoped that in time the whole intake will come from the schools.

The Commandant at Risalpur—the P.A.F.'s Cranwell—is G/C. M. Khyber Khan; the station C.O. is W/C. W. Khan. The Commandant's lieutenants in the college are W/C. A. Hussain (director of studies) and W/C. Poly Shah (chief instructor). Intakes at six-monthly intervals or less are designed for 75 students though the P.A.F., like other air forces, has some difficulty in maintaining the number of aircrew recruits it would like; there are plenty of other openings in Pakistan's growing industries.

The course at Risalpur lasts two years and in addition to flying training there are four spheres of academic work—aeronautical sciences; humanistic studies; Air Force requirements, general Service training—and various extra-curricular activities. The syllabus is nothing if not comprehensive; and considering that the aerosciences section, for example, sub-divides into eleven separate subjects and the humanistics includes language tuition in English, Urdu, and Bengali, it cannot be said that the P.A.F. pilot's education is one-sided.

Flying training at Risalpur is carried out on Harvards, pupils doing 125 hr dual, 65 hr solo, and 20 hr on grading tests—a total of 210 hr. In addition they do 25 hours on the Link Trainer. From the college, graduates go either to fly T-33s at No. 2 Fighter Conversion Squadron at Mauripur, or Bristol Freighters with No. 3 Transport Conversion Squadron at Lahore. Whether they become fighter or transport pilots depends partly on their individual ability and temperament, partly on squadron requirements. The college, whose administration is controlled by a Board of Governors nominated by the Government of Pakistan, comes under the jurisdiction of No. 1 Group of the P.A.F., which controls all operational and training flying.

Facilities at Risalpur are impressive and the instruction given has obviously been carefully thought out; for example a self-briefing room with numbered wall charts ensures that nothing is forgotten by the u/t pilot before he sets out on a flight; a library of 12,500 books provides him with the means for a complete general and technical education; and a blow-type "wind tunnel" which has been ingeniously constructed on the Schlieren method gives him a lantern-slide view of an aerofoil at supersonic speeds.

When a Risalpur graduate proceeds to No. 2 F.C. Sqn. at Mauripur (the work of No. 3 T.C. Sqn. at Lahore has already been briefly described), his first 12 weeks are spent doing 80 hr flying on T-33s and 125 hr ground school study. If successful in that three months' training he then goes to Korangi Creek (whose main function as the Apprentices' Training School has similarly been described) for two weeks' instruction on the engine and ancillary mechanisms of Sabres. Returning to Mauripur, he does 50 hr flying on Sabres to fit him for operational duties and at the same time has 100 hr ground instruction. There are two points of especial interest about the methods and standard of training at No. 2 F.C.S. One is that if a pilot does not make the grade he may lose the brevet he gained at Risalpur; and another is the use of the American system of "chase pilots." On his first few solos in a Sabre no P.A.F. pilot goes into the air unaccompanied; an instructor flies with him in another aircraft to watch his manœuvres and help him by R/T. to perform them correctly.

No. 2 F.C.S. is commanded by S/L. M. K. Abbasi and it started flying turbojet aircraft in May 1955. (Originally the squadron—then called a school—was at Risalpur and in 1949-50 it was run by A.S.T.) Out of 120 pilots who have so far come on courses, 105 have qualified; and it is satisfying to record that after 8,000 hr flying on T-33s and 900 hr on Sabres there has only been one fatal accident and no major ones—none of these having occurred on the Sabres. As the C.O. puts it: "We think this is because of our training on the T-33s." In addition to training potential fighter squadron members, No. 2 F.C.S. gives a "short" (six-week) course to staff officers; convert pilots who have not hitherto flown turbojet aircraft; and does all I.R. training of Sabre and Fury squadron pilots, who have to get a rating every six months. All the present No. 2 F.C.S. instructors did their flying training in Pakistan, some of them subsequently having advanced training in the U.S. or Germany; and a measure of their standard is given by the fact that when the C.F.S. examining team came to categorize them, it awarded two A2s and five B1s.

At present most of the total fighter strength of the P.A.F. is gathered at Mauripur (which is commanded by G/C. S. A. Joseph), but new dispositions of the Sabres are being made.

The squadrons will eventually be positioned (in addition to Mauripur) at Peshawar, Sargodha and Quetta—the two last-named airfields being reconstructed to accommodate Sabres. As can be seen from the map of West Pakistan, these sites are strategically effective for the defence of Karachi and of the country's northern, eastern and western frontiers. Although the number of squadrons is small, it can be presumed from what one has seen of their training—the most important aspect of their peacetime operations—that they are highly effective as DF/GA units. Indeed, the impressive display put on by the Sabres at Mauripur on February 2 [reported in detail in *Flight* for February 14] and the Furies' demonstration at Miram Shah gave visible proof of the squadrons' discipline, accuracy and flying ability. Their training programmes, based on both U.S.A.F. and R.A.F. systems with the P.A.F.'s experience of local conditions added, are carried through with great enthusiasm and thoroughness; practice interceptions have brought good results and the standard of air-to-air and air-to-ground firing—judging by films shown and the mock attacks made at Mauripur and Miram Shah—seems to be high. But it was particularly stressed by the C-in-C. when speaking of the P.A.F. fighter squadrons that their rôle is a purely defensive one.

Before closing this account of the P.A.F., mention should be made of one of its non-flying branches, the Ground Combatteers. This is the P.A.F. equivalent of the R.A.F. Regiment and its prime function is, similarly, the defence of airfields. It has units both at Mauripur and Peshawar.

At these stations, as at Lahore, Kohat, Miram Shah, Sargodha and Risalpur, a warm and kindly welcome was extended and every opportunity given to see the P.A.F.'s work in all its aspects. It was a stimulating experience to see a young Service growing up and, having decided on its function in the new Republic of Pakistan with its responsibilities as a member of the Commonwealth and of the Baghdad Pact and SEATO, flexing its muscles. The cynic might have expected to find, behind the outward glamour of the R.A.F.-type uniforms, something of a pastiche of the R.A.F.; but this was far from being the case, and the more one saw of the P.A.F. the more one admired its discipline and thoroughness—for those were the two qualities constantly predominant. It has yet to be tested in full-scale action; and one hopes such a dreadful opportunity for operational proof will never arise. If it should, one feels confident that the P.A.F.—despite its smallness—would acquit itself well.

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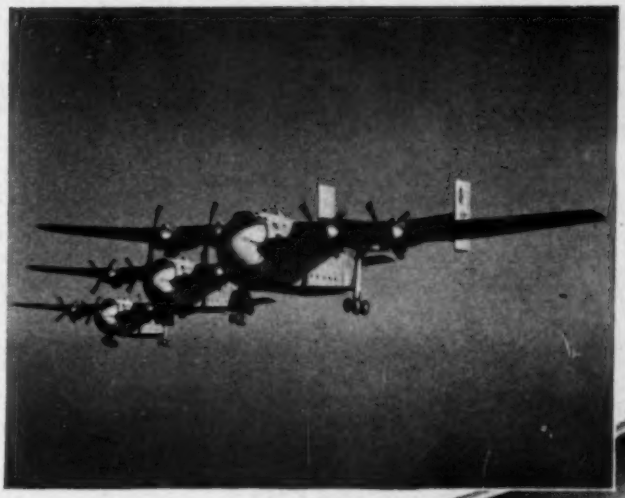

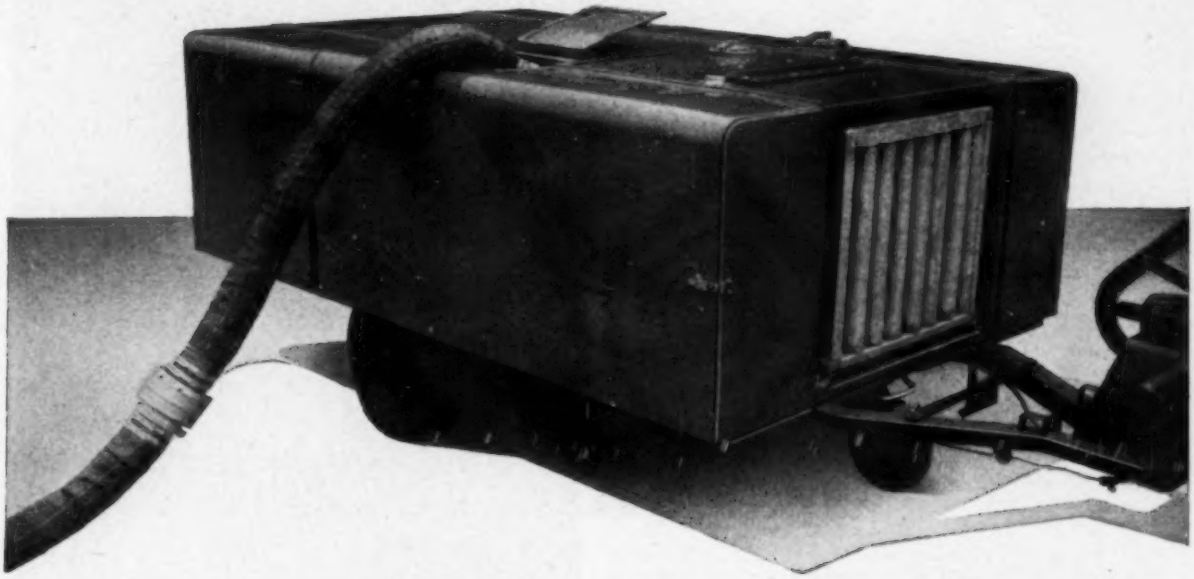

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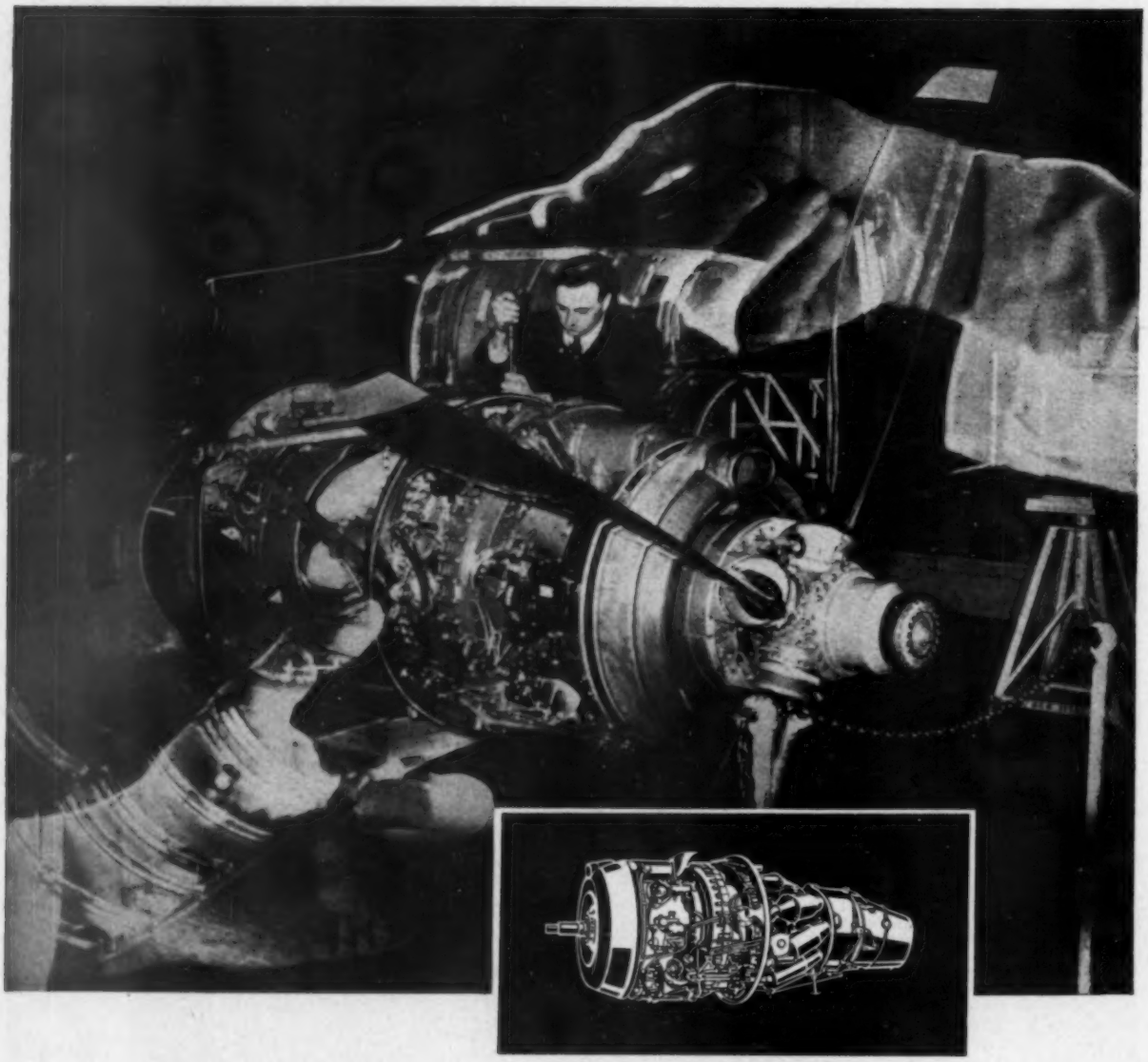

The Rolls-Royce Dart has now completed 4,000,000 airline hours

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Ossun airport, six miles from Lourdes, is being enlarged to cater for the growing volume of air traffic. Two Starways DC-3s are seen to the left of the new air terminal, construction of which is nearly complete.

CIVIL AVIATION

THE D.H.121 CONSORTIUM

ON Wednesday, February 19, the first Board meeting of the Aircraft Manufacturing Company was held at Hatfield. The seven directors of the new company—formed to develop, produce and market the D.H.121—have been selected from the boards of the three parent companies, de Havilland Aircraft Company, Ltd., Fairey Aviation Company, Ltd., and Hunting Aircraft, Ltd. Chairman of the new company is Mr. W. E. Nixon (chairman, de Havilland), the deputy chairman is Mr. Richard Fairey and the managing director Mr. A. F. Burke; the other directors are Mr. C. P. M. Hunting, Mr. A. S. Kennedy (de Havilland), Mr. F. E. N. St. Barbe (de Havilland) and Mr. W. A. Summers (Hunting).

The nominal capital of the Aircraft Manufacturing Company is at present £100, shared in the proportion de Havilland 67½ per cent, Hunting 22½ per cent and Fairey 10 per cent. At the initial board meeting it was agreed that capital would soon have to be increased to £1m, the basis of allocation remaining as at present.

Four executive teams—finance and administration, technical organization, production, and marketing—are already being appointed from the ranks of the three parent companies.

The original Aircraft Manufacturing Co. (known as Airco) was founded by George Holt-Thomas during the First World War and, with Geoffrey de Havilland as designer, was responsible for producing the early D.H. types. Immediately after the war Holt-Thomas, using Airco D.H.4s, had the distinction of inaugurating Britain's first scheduled air service, London-Paris. Not long afterwards the company was taken over by B.S.A., the aircraft manufacturing side being abandoned but the air transport activities (under the name Daimler Airways) continuing until 1924, when services were bought out by Imperial Airways.

Since the days of George Holt-Thomas the name Airco has been adopted by another British company. For this reason the old abbreviation will not be used by the new consortium: a suitable short title has not yet been decided upon.

B.E.A. and M.T.C.A. officials, suitably clad in fur caps and collars, departing for Moscow to discuss the technical details of the proposed service linking the Russian and British capitals. Viscount G-AOHO was the first foreign turboprop to visit Russia.

AIR SERVICES TO MOSCOW

INAUGURATION of a direct air service between London and Moscow came a big step nearer with the departure last week of an 18-man British team to Moscow to discuss the technical aspects of the proposed service. The principal items on the agenda related to engineering arrangements, traffic control and navigational aids available on the sector between Copenhagen and Moscow. Illustrative of the present knowledge of Russian facilities was the fact that the Viscount 802 used to convey the delegation carried in its hold a specially made Dagenite battery starting unit, taken to avoid possible embarrassment arising from the severe weather conditions expected at Moscow.

The day on which the British team returned to the United Kingdom saw B.E.A.'s chairman, Lord Douglas of Kirtleside, fly out to Moscow to continue discussions with Air Marshal Zhigarev. An important topic to be considered was the relationship between the London - Moscow service, and services eastward from Moscow. On February 12 a Tu-104 (with 105 passengers on board) took off from the Russian capital on the first regular jet flight to Vladivostock. This 4,750-mile journey now takes 11 hours (to Tokyo would take an extra hour) and could allow a passenger travelling from the U.K. to the Far East to save about 20 hours on the schedules offered by B.O.A.C. and other European airlines. Present in Moscow to witness departure of the Tu-104 was an Indian delegation engaged in negotiations over the proposed service between Moscow and Delhi. It is likely that inauguration of this service will almost coincide with that of the London - Moscow service, and will open up an alternative route to India. Aeroflot will place Tu-104s on the Delhi service, the one intermediate stop being made at Tashkent. Air-India will use L.1049Gs.

GUN LAW

ACCOUNTS of airliners being forced to divert by Communist agents, and pilots and passengers threatened with violence, belong more to fiction—or to the story of Shangri-La—than to real life. Nevertheless, something very much akin to this apparently happened on the borders of North and South Korea on Monday of last week when a DC-3 of Korean National Airlines, on a flight between Pusan and Seoul was "diverted" into North Korea. Among the 32 people on board were an American pilot, Col Howard McClennan, U.S.A.F., who was acting as co-pilot (he is an adviser to the South Korean Air Force), Col Kim Ki Wan, chief information officer of the South Korean Air Force, two German sales agents, a South Korean Member of Parliament, and two men wearing South Korean Army uniform. These two men, suspected by the Korean national police of being Communist agents, forced the pilot to fly into North Korea.

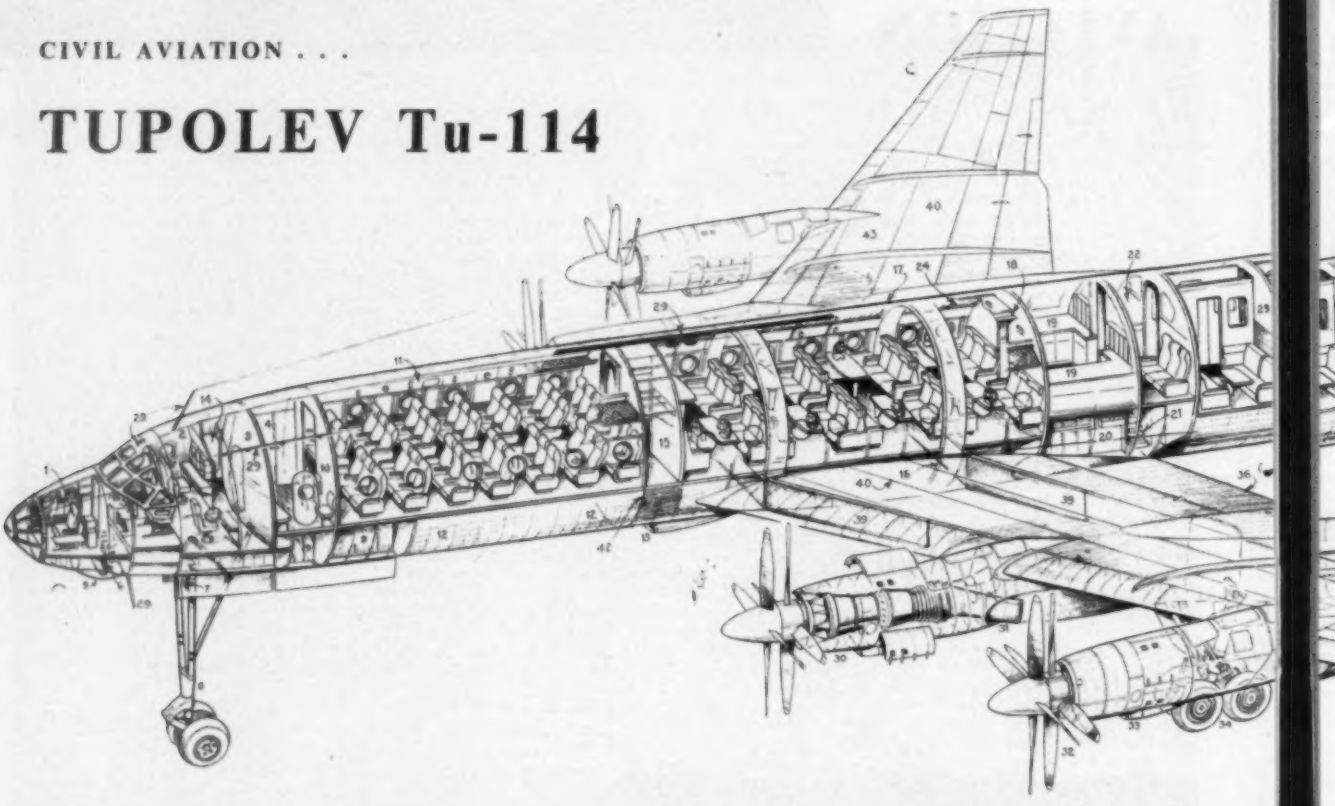
The Communist radio at Pyongyang claimed that the airline passengers had landed north of the 38th parallel because they "could no longer put up with the daily pressure of the Fascist Government, Imperialist oppression and the war policy of the American Imperialists." They quoted Hwang Hae Soo, who was identified as one of the passengers—although there was no record of his name on the passenger manifest at Pusan. North Korea later rejected a formal United Nations demand for return of the aircraft. Korean National Airlines operate three DC-3s and one DC-4.

The following day, the Lebanese airline Air Libane were also in political difficulties. One of their aircraft was forced to land at Damascus by Syrian jet fighters while on its way from Beirut to Jerusalem. It was being flown by an American pilot, who denied the Syrian allegation that he had flown over a forbidden military area; and he added that his take-off from Beirut was made 55 minutes after Syria claimed that her radar had detected the aircraft. The journey was continued six hours later.

1 Navigator's station
2 Flight engineer and radio/electronics operator
3 Pressure (safety?) bulkhead behind flight deck
4 Forward toilets
5 Radome
6 Search radar
7 Landing/taxi lamp
8 Rearward-retracting, levered-suspension nose gear
9 Nose-gear bay
10 Stewards' seats
11 Forward cabin (42 six-abreast seats shown)
12 Underfloor freight hold; loading door to starboard
13 Cabin-air ram intake
14 Crew entry door
15 Coat stowage
16 Main-spar fuselage frames
17 Centre cabin (48 six-abreast pull-man-type seats shown)
18 Double strip lighting
19 Serving area
20 Pantry on lower deck, two electric lifts to upper deck
21 Stairway
22 Stairway to starboard, three seats (possibly crew rest) to port
23 "Roomettes," each with two divans and one folding bunk, or six seats
24 Folding racks
25 Aft cabin (72 eight-abreast seats shown)
26 Passenger entry door
27 Wash/powder rooms, port and starboard
28 Aft toilets (four)
29 Aerials
30 NK-012M single-shaft turboprop engines
31 Bifurcated exhausts
32 18ft 4in diam counter-rotating reversing propellers
33 Oil-cooler ram-air intake
34 Rearward-retracting main bogies
35 Undercarriage nacelles
36 Fowler-type flaps
37 Boundary-layer fences
38 Spoiler
39 Main-spar booms
40 Parallel skin planks
41 Thermal anti-iced leading edge, 35 deg sweep
42 Ice protection strip
43 Fuel, 176,370 lb
44 Retractable tail-bumper (two wheels)

CIVIL AVIATION . . .

TUPOLEV Tu-114



THE illustration above of the world's biggest transport aeroplane has been prepared by *Flight* artists from new drawings and photographs released by the U.S.S.R.

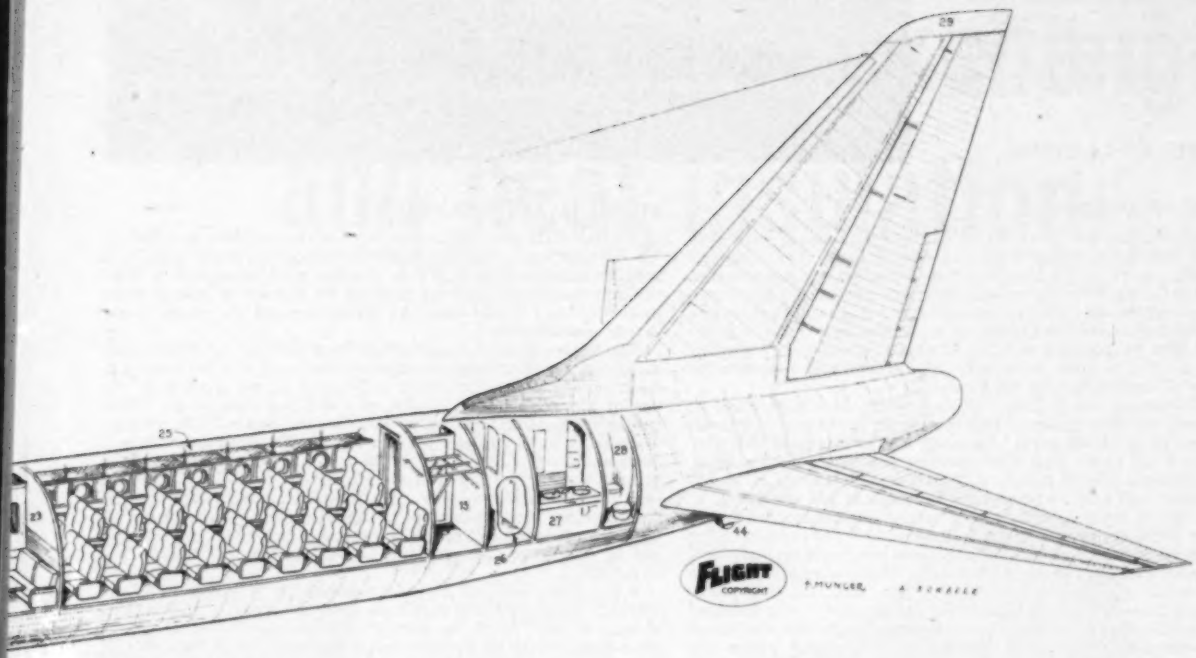
The photograph (far right) is the first to conform that the Tu-114, of which the first picture appeared last November, has actually flown; and it reveals also the great sweep and high aspect-ratio of the 177ft-span wing.

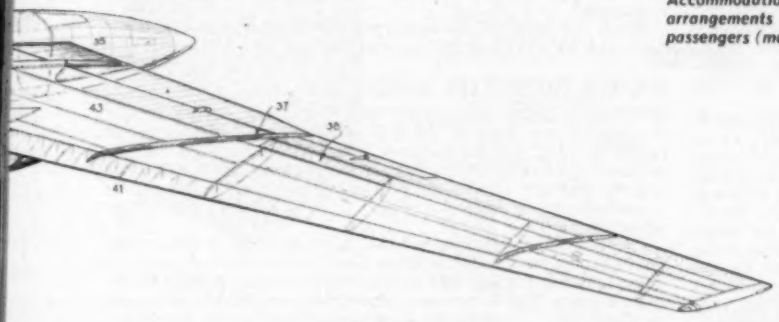
Not only is the Tu-114 the largest-spanned transport flying (exceeding the Armagnac by almost 17ft); it is by far the heaviest. Gross weight is more than 413,000 lb: in other words the fully laden Tu-114 weighs at take-off 118,000 lb more than the heaviest of America's two big jets, the Boeing 707-320 Intercontinental (295,000 lb).

Furthermore the Tu-114 concedes little to the big jets in speed —565 m.p.h. cruising at 30,000ft—and it appears to offer considerably greater payload-range performance. Quoted figures suggest that the big Russian turboprop can carry its full payload of 39,683 lb for a distance (no mention is made of conditions) of 6,210 miles. Ultimate range is given as 9,000 miles.

Accórding to Aeroflot the Tu-114 will be on Russian domestic routes this year. Russian publicity has emphasized its "rail-fare" economy, and the impact of such an aeroplane on international routes—which the Russians no doubt intend the Tu-114 shall in due course serve—may well strain I.A.T.A.'s fare-making machinery.

The Soviet challenge on the world's air routes—when it comes —will be mounted with something of the steamroller force that, thirteen years ago, characterized the progress of the Red Army, with Tu-114s filling the rôle of the Stalin tanks. The two formidable supporting echelons consist of three turboprops—the An-8, Il-18 Moscow and the capacious An-10 Ukraine—and two turbojet transports, the Tu-104 and Tu-110.





Accommodation shown in this "Flight" copyright drawing is typical: various arrangements have been announced, including a layout for 220 tourist passengers (mostly eight abreast), and another for 120 passengers in mixed three-abreast and two-abreast seating.

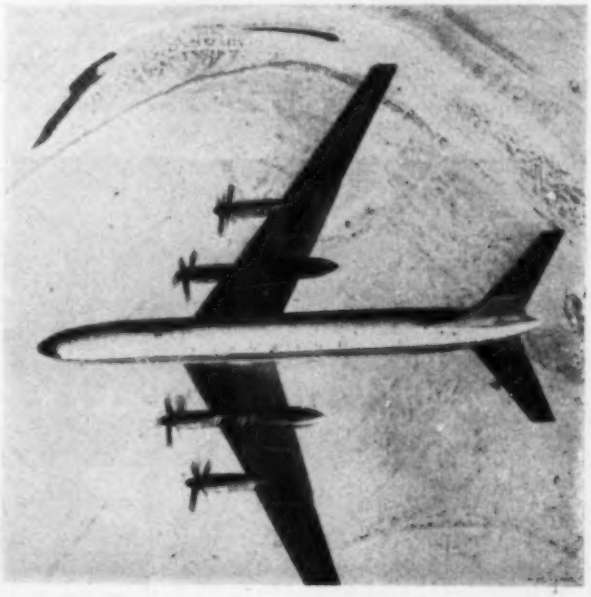
TUPOLEV Tu-114

Four Kuznetsov NK-012M or 022K turboprops of 12,000 s.h.p. plus 1,200 kg (2,645 lb) thrust each

Dimensions: Span, 54 m (177ft 2in); length, 47.2 m (154ft 10in); height, 11.8 m (38ft 8¼in); wing area, 280 m² (3,013.9 sq ft); aspect ratio, 10.4; propeller diameter, 5.6 m (18ft 4¼in).

Weights and loadings: Max. take-off weight, 187,750 kg (413,915 lb); empty weight, 85,400 kg (188,274 lb); fuel, 80,000 kg (176,370 lb); oil, 3,000 kg (6,614 lb); weight of crew (15 in number), 1,350 kg (2,976 lb); remaining allowance for payload, 18,000 kg (39,683 lb) (this can be increased, according to American reports, up to 30,000 kg); max. landing weight, 125,000 kg (275,573 lb); wing loading, 670 kg/m² (137 lb/sq ft); power loading, 3.6 kg/e.h.p. (7.936 lb/e.h.p.).

Performance: Max. cruising speed at 9,000 m (29,530ft), 910 km/hr (565 m.p.h.); at 10,000 m (32,808ft), 855 km/hr (531 m.p.h.); take-off at full weight, 272 km/hr (170 m.p.h.); landing speed, 205 km/hr (125 m.p.h.); time to 10,000 m, 36.5 min; "practical ceiling," 10,400 m (34,120ft); "normal range," 10,000 km (6,214 miles); "max. range," 14,500 km (9,010 miles); take-off distance to 15 m (50ft, presumably field length), 2,850 m (9,350ft); landing distance from 15 m, 1,800 m (5,900ft) with reverse pitch, 2,650 m (8,690ft) without.



A 50-seat Curtiss Commando C-46R (2 P.W. R-2,800 34s) demonstrated at Southend by the owners, Fred Olsen Airtransport. Conversion of Olsen's three C-46s was carried out in Venice. "Flight" photograph

CIVIL AVIATION...

K.L.M. WAVERING

OVER the last few years B.O.A.C. has been looking back over its shoulder at its faster-growing rival K.L.M. Five years ago the traffic carried by the Dutch airline was only three-quarters that of B.O.A.C. By 1956 the margin had been reduced to a few per cent, and by last year the gap was so narrow that until final figures are published it will be difficult to know whether or not K.L.M. moved into the position of being Europe's second largest carrier. (B.O.A.C. and K.L.M. each carry only about three-quarters the amount of traffic lifted by Air France.)

Unfortunately for K.L.M., the loss of the important route to Indonesia has now meant a reduction in the rapid rate of growth experienced in recent years. Capacity will be increased this year by only 8 per cent. This slowing-down has been reflected in an announcement that K.L.M.'s staff, at present standing at 17,300 employees, will have to be reduced by between 500 and 1,000.

The Board has proposed that the annual general meeting (to be held in May) approves of a final dividend of 4 per cent, bringing the annual distribution to 7 per cent. This was based on last year's successful financial record. At the a.g.m. there will no doubt be a division of opinion between those who feel that reasonable dividend rates must be maintained if expansion is to be financed from public issue of shares, and those who believe that the loss of Indonesian traffic demands that funds be retained within the organization as much as possible. The loss of revenue has been estimated at Fl.22m (£2m), equivalent to 4½ per cent of K.L.M.'s total revenue.

To maintain an up-to-date fleet without either straining the company's finances or providing excess capacity necessitates reduction in size of the DC-4, L.749 and Convair 340 fleets. Impending additions include two DC-7Cs (K.L.M. has options on three more of these aircraft) and three L.1049Hs, purchased particularly to cater for the economy-class traffic.

The major development planned for this year is the opening of "Route 75" in November. This route, following roughly along latitude 75 deg, will proceed westward via Anchorage to Tokyo, and then on to Biak. Although this route is 1,200 miles longer than the present service via South East Asia, elapsed time to Biak will be slightly less as a result of a reduction in transit-stops. However, this new route will cut the distance to Tokyo by 1,500 miles.

Other new services include a once-weekly flight to Abadan and four flights per week terminating at Prestwick. (This last service, using Viscounts, will be the first direct turboprop link between Scotland and the Continent.) During winter the convertible L.1049H will be transferred to transatlantic freight duties, allowing the present frequency of two flights per week to be doubled.

K.L.M. also plans changes on the home front. In June the new engine workshop at Schiphol will be ready for use, and in about a year's time the freight-sheds will have been extended to offer about double the present space. K.L.M. is also collaborating with the Hilton hotel organization, and is contributing funds to facilitate rapid construction of two 250/300-room hotels, one in Amsterdam, the other in Rotterdam.

An interior view of the V.I.P. layout provided for the Prime Minister and Lady Macmillan on their recent Commonwealth tour in a Britannia 102. The layout was designed and installed by B.O.A.C.

MUNICH AFTERMATH

ALTHOUGH the official inquiry into the accident to a B.E.A. Elizabethan at Munich-Riem on February 6 is not to be held until sometime in March, B.E.A. were last week prompted by West German speculation into the cause of the disaster to issue a statement that they would make no comment until the result of the inquiry was known.

The freely-offered opinion of the West German inspector of air accidents, that the crash had occurred as a result of wing icing, was taken up at a Press conference in Munich by the director of the airport, Count Dieter zu Castell, who said that icing on the Elizabethan's wings had been established "beyond doubt." The director discussed also an earlier remark made by Mr. Anthony Milward, chief executive of B.E.A., that "What would have been a simple mishap was turned into a major disaster by the house" [situated near the end of the runway]. On the other hand, said Count zu Castell, if the aircraft had not struck the house, it might have hit the road, exploded and killed all the passengers. The house would not be rebuilt, and the runway would be extended from 6,230ft to 8,530ft.

B.E.A., who say that they are impressed with the action of the German authorities and with their sense of urgency, said in their statement that "Since the moment rescue work ceased an urgent investigation into all possible causes has been going on. We can say that we ourselves quickly formed our conclusions as to the most likely cause of the accident, and immediate action was taken on a number of points with a view to preventing any possible repetition."

When the report of the inquiry is published B.E.A. may issue their own statement on the cause of the accident.

B.E.A.'s DOMESTIC FARES

PUBLICATION of summer schedules reveals the effect, in terms of new fares, of B.E.A.'s efforts to increase the revenue earned on their internal services. The main routes least affected are those to Manchester and Belfast. Return fares between London and Birmingham, Edinburgh, Glasgow, Jersey and Guernsey have been increased by about £1, while that to the Isle of Man will go up by over £2.

These increases are part of B.E.A.'s campaign to reduce the deficit shown on domestic services. Until recently the Corporation's annual reports implied that the domestic services resulted in real financial loss. The latest report was more guarded and, noting that the figure was reached after an arbitrary allocation of overheads, pointed out that a deficit of £1,371,000 did "not mean to suggest that we should have been £1,371,000 better off . . . if we had not operated the domestic routes." Unfortunately, the Corporation's allocation of overhead costs is not audited, so it is impossible for an outsider to know how "reasonable" is the basis of allocation. A quick inspection of the accounts, however, gives the impression that overhead expenses have been "loaded" on to domestic services.

The volume of total domestic traffic carried by B.E.A. in 1956-1957 was exactly one-third of international traffic. Yet, to take two important items of overhead, crew pay and allowances on the one hand and station costs on the other, the cost borne by domestic services expressed as a percentage of that borne by international services was 61 per cent and 57 per cent respectively. (To allocate a Viscount captain's salary, or the expense of running London Airport, in such a way as to show a realistic balance between domestic and international routes is a problem to tax an accountant's imagination to the limit.) If the basis of overhead allocation were known, then the public would be in a position to judge whether the present allocation were "reasonable." On the present evidence there are strong grounds for supposing that the costs of domestic services are deliberately shown up in a gloomy light.

There still remains the fact that B.E.A.'s internal services are less profitable than those to the Continent. Fares are about to be increased on these international flights under the terms of recent I.A.T.A. agreements. But on these routes the effect to the travelling public is mitigated by the extension of mid-week and night-tourist reductions.

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SW/56

PanAm's first Boeing 707, due to be delivered in December, is shortly to join the first production aircraft in the flight test programme.

CIVIL AVIATION . . .

Continued from previous page

A growing body of opinion believes that the financial situation on domestic services could be improved by increasing the gap between peak fares and off-peak fares rather than by an increase in fares generally. The effects of such fare differentials would be twofold. First, it would encourage a more regular flow of traffic. Peak traffic can probably stand a slight fare-increase without diminishing in volume, while a relatively untapped amount of off-peak traffic would be enticed into the air by lower fares. The second effect would be to increase aircraft utilization. The size of B.E.A.'s fleet is necessarily tailored to something approaching peak demand, and mid-week utilization is consequently low. Extension of mid-week domestic services by the use of aircraft standing by for week-end operations would increase utilization and so cut the incidence of overhead costs.

The Port of New York Authority's studies have revealed that the demand for local air services in New England comes primarily from business traffic, and while comparable figures have not been published in the U.K., it is probable that the same position would obtain here.

Despite the energetic activity of DC-3 users such as B.K.S. and Starways, B.E.A. have not in the past favoured the use of these aircraft on short-haul domestic operations. It is possible that as the Viscount 802s take over B.E.A.'s international routes the earlier 701s will be transferred on to domestic operation. Should this come about, it will then be even more necessary to attract non-peak traffic than at present.

PACIFIC-U.K. NON-STOP

ANOTHER record long-range stride was made last week by the Bristol Britannia. Canadian Pacific's first 314 flew non-stop the 4,710 st. miles (great-circle distance) from Vancouver to London in 13 hr 57 min, an average speed of 338 m.p.h. Actual distance flown by the aircraft was about 5,000 st. miles.

The Britannia concerned, CF-CZA, had been to Vancouver on a goodwill-*cum*-training flight from Bristol, in order to provide the dedication of C.P.A.L.'s Britannia hangar with the appropriate *éclat*. The aircraft (which is still on manufacturer's trials) was commanded by Bristol's chief test pilot, Walter Gibb. Among the 37 on board were Mr. P. G. Masefield, Bristol's managing director; Mr. R. E. Harvey, director and general manager of Short Brothers and Harland, Ltd. (who are building C.P.A.L.'s aircraft); Capt. W. Roxborough, chief pilot of C.P.A.L.'s Britannia fleet; Short and Bristol technicians; and a member of *Flight's* staff.

Hopes that the crossing might have broken El Al's 6,100-mile New York - Tel Aviv Britannia record were not sustained by the necessary high tailwinds; in fact, the average component was a mere 10 kt. Nevertheless, the aircraft landed at London with sufficient fuel for more than two hours' cruising, having, according to Mr. Peter Masefield, "exceeded its guaranteed performance on all counts."

It is hoped to publish a first-hand illustrated account of C.P.A.'s Britannia plans in next week's issue.

BREVITIES

ORDERS announced last week include three Boeing 707-320s for South African Airways and six F.27s for Aviacion y Comercio.

* * *

The Dart Herald is due to be rolled out of Handley Page's Woodley works this week.

* * *

Two of Federation Air Services' five Beavers will be put up for sale when F.A.S. is taken over by Malayan Airways on March 1.

* * *

Swissair's Board of directors has proposed an increase in the company's share capital from Sw.F.42m to Sw.F.63m.

* * *

Design of the Dresden 153, a medium-range four-engined turboprop airliner for East German Lufthansa, is reported to be nearing completion.

* * *

The Cardiff Corporation and the M.T.C.A. have agreed on an 18-acre site for a heliport, to be situated on Leckwith Moor, less than a mile from the centre of Cardiff.

* * *

Deutsche Flugdienst, of Frankfurt, have purchased five Convair 340/440s from K.L.M., and have an option on a sixth. This German independent, in which Lufthansa holds a major share, plans to acquire four-engined aircraft later this year.

* * *

B.O.A.C. will replace their Britannia 102s by 312s on the London - Nairobi route after July 31. Next spring the 102s on the routes to Sydney and Tokyo will be replaced by Comet 4s.

* * *

The Minister of Transport and Civil Aviation, Mr. Harold Watkinson, revealed in a written Parliamentary answer last week that Croydon airport will be closed at the end of this summer.

Swissair have appointed Mr. Ernest Schmidheiny to be chairman in succession to the late Dr. R. V. Heberlein. Mr. Schmidheiny joined Swissair's board in 1947.

The Air Transport Association claims that introduction of the three-dollar fine has cut the number of "no-shows" by a half.

* * *

An internal helicopter service linking Milan, Turin and Genoa is planned to start on April 10.

* * *

T.W.A. is to acquire the four L-1649s originally ordered by L.A.I., bringing T.W.A.'s fleet of these aircraft to 29.

* * *

American Airlines have appointed as director of aircraft sales, Mr. Allan A. Barrie, formerly general manager of Iranian Airways.

* * *

A Catalina belonging to R.A.I., a subsidiary of T.A.I., crashed last week while landing at Raiatea Island, near Tahiti. Fifteen people were killed.

* * *

A prediction that the U.S.S.R. will have a VTOL supersonic transport "in the near future" has been made in an article in the Soviet magazine *Tekhnika Molodezhi*.

* * *

Japan Air Lines are about to take delivery of two DC-4s purchased from PanAm for about $400,000 each. A further two DC-4s have been sold by Northwest to Trek Air, the South African independent.

* * *

Mr. John Leydon, chairman of Irish Airlines (Aerlinte Eireann) announced in New York on February 11 that the company would begin operations on April 28 with three round trips per week. A daily service will be operated in each direction as from June 1.

* * *

The first party of Aer Lingus technicians is in Amsterdam to begin F.27-training at Fokker. The first Friendship, due for delivery to Aer Lingus in the autumn of 1958, is expected to make its maiden flight in March.

* * *

B.E.A. has been approved by the Minister of Transport, on the recommendation of the A.T.A.C., for the operation of air services between London, Gatwick and Southend until December 1964. No inauguration date has been announced; it will depend upon traffic demand and the availability of aircraft—fixed-wing or helicopter.

* * *

New B.O.A.C. Stratocruiser services to Accra and Lagos starting in early March will be routed via Barcelona and Lagos. An initial frequency of three a week will be increased to four in April. A 30-day stop-over is allowed in Barcelona on the north-bound journey from West Africa to London, and the Corporation has traffic rights in both directions between Barcelona and West Africa. No stop-overs or terminating traffic may be carried between London and Barcelona.

CLUB AND GLIDING NEWS

AT the invitation of the British Gliding Association, Kenneth Owen of *Flight* is to travel to Leszno, Poland, in June as Press and Publicity Officer to the British team for the World Gliding Championships. Previous gliding contests which he has reported for *Flight* include the world championships of 1954 (Great Hucklow) and 1956 (St. Yan); and the nationals of 1955 and 1957 at Lasham.

CELEBRATING the 30th anniversary of the formation of the Plymouth Aero Club, a dinner dance was held on February 14. At the dinner, the health of the club was proposed by the Town Clerk of Plymouth, Mr. S. Lloyd-Jones, and Mr. W. H. W. Lucas, manager of Roborough Airport, replied. Twenty-five years ago, Mr. Lucas pointed out, club membership totalled 34 and 300 hours were logged during the year. This compared with the current membership of 420 and an annual flying total of 3,229 hours. Considerable stimulus to the operations of the club had been given by the training of midshipmen from the Royal Naval College, Dartmouth. Referring to the need for training for potential airline pilots, Mr. Lucas claimed that flying clubs could provide efficient instruction at a fraction of the cost of larger organizations. The toast of the guests was proposed by Stanley Edgecumbe, and A.V-M. G. I. L. Saye of No. 19 Group, R.A.F., replied.

ANNUAL ball of North London Aero Club, Panshangar, will be held on Friday, April 11, at the Cranbourne Rooms, Hatfield. Among the attractions planned for this function is the appearance of the Dagenham Girl Pipers.

SEVENTH Congress of the Organisation Scientifique et Technique Internationale du Vol à Voile (OSTIV) will be held at Leszno, Poland, from Thursday, June 12 to Friday, June 20. This period begins during the practice week prior to the World Gliding Championships, and ends halfway through the contests. During the congress, OSTIV will award a plaque for "the most noteworthy scientific contribution to soaring flight." Details of the technical papers to be presented at the meeting will be given in a forthcoming issue.

OXFORD Aeroplane Club, based at Kidlington, has just completed the most successful year since its activities recommenced after the war in 1946. Flying hours amounted to 1,424, and 20 Private Pilots' Licences were gained. At present several club pilots are receiving C.P.L. flying instruction. The club fleet consists of four Tiger Moths and one Chipmunk with, in addition, an Aiglet available if required. Lectures on theory of flight, navigation, meteorology and radio procedures have been held during the winter, and improved accommodation is being provided in a new clubhouse building. The chief flying instructor of the club, which hopes to hold its second At Home this summer, is Mr. C. F. Cockburn.

BOTH power flying and gliding are included in the operations of the South African Air Force Aero Club, one of the largest flying clubs in South Africa. Based at Air Force station Swartkop, just outside Pretoria, with a branch at Langebaan in the Cape, the club has 17 powered aircraft, five gliders and about 60 members. Membership is open to all Services personnel.

The club commenced flying in the early 1930s, and was re-formed after the war in 1947. The intention was to provide flying for any member of the permanent Forces at the cheapest practicable rate. This aim has been maintained throughout and, although flying fees have inevitably risen together with running costs, it is still possible for club members to fly for only 36s per hour. This is further reduced by the South African government subsidy scheme under which a pupil receives a £60 grant on gaining his Private Pilot's Licence. It is therefore possible to obtain a P.P.L. for less than £50, which has made flying a reality for members of all three Services.

All aircraft repairs and servicing are carried out by club members themselves, under the expert guidance of Sgts. Moolman and Naude. The chairman of the club, Maj. D. Pidsley, D.F.C., is also the C.F.I.; his team of instructors includes Capt. T. Vanston, Capt. "Ginger" Keightly, Lt. E. Pienaar and Lt. Van der Westhuizen, all qualified Service instructors. The club's treasurer (and founder member) is Capt. "Blackie" Swardt.

Training is carried out in two Piper Cubs and two Tiger Moths. A recent addition to the fleet is a Piper Tri-Pacer which, used solely for touring, is in constant demand for trips to places such as Port Elizabeth, Durban and Lourenço Marques for leave or week-ends. Gliding, under Sgt. Swart, has a large following, and one of the Tigers is used for aerotows. Thermal-hunting over the Transvaal has become a satisfying pastime.

The club flies under both Service and civil regulations and, apart from three emergency landings, has an accident-free record. Considerable interest in the club has been shown by senior S.A.A.F. officers, and its activities have now been officially recognized as a sport in the Service.

AT THE KRONFELD

POPULAR rendezvous for light-aircraft and gliding enthusiasts in London is the Kronfeld Club, scene of these informal sketches by Gordon Horner. Situated in the basement (renovated and redecorated by members) of 74 Eccleston Square, near Victoria Station, the club caters for a wide range of interests in its regular Wednesday-night talks and film shows. Also on the programme are fortnightly general-feature films, and introductory talks on gliding on the first Tuesday of each month. Pictured here are the bar (left); the coffee-bar corner (upper left); and the lecture room (above) during a recent film-strip talk on clouds by Dr. R. S. Scorer. This month's talks have included *The Oxygen Story* by G. Melvill-Jones, *Flying and Motor Racing* by Ron Flockhart, and *North Wales, the Soaring Pilot's Paradise* by Bill Crease.

SERVICE AVIATION

Royal Air Forces and Naval Flying News

The Navy Estimates

THE following are points of particular aviation interest arising from the Navy Estimates published on February 18:—

Provision has been made in the Estimates for gross expenditure of £410,650,000, i.e., £24,250,000 more than the comparable provision in the Estimates for 1957-58.

The carriers will continue to be the core of the new Navy. Their versatility is a reflection of the versatility of the Navy as a whole. Like all other H.M. Ships, the carrier helps, by goodwill visits to foreign countries, to cement old friendships and to foster new ones. It is a potential reinforcement for any policing action which may have to be taken. In war it can provide strike forces for use against ships or in support of ground operations. It can contribute to the protection of the Fleet, of which

Vickers-Supermarine Scimitar.

it is the centre. With its anti-submarine aircraft it can actively hunt down and kill enemy submarines. Grouped around the carriers will be supporting ships carrying the latest weapons for dealing not only with the air threat, but with surface and underwater attacks and capable of acting by themselves on detached service.

Disposition of Fleet. In the East the responsibilities of the United Kingdom and Commonwealth are particularly large and scattered. They stretch from Aden to Hong Kong and from Mombasa to the South Island of New Zealand. This area also includes the countries of the South-East Asia Treaty Organization. To contribute to the Commonwealth support of these interests it is intended to maintain continuously one carrier, with supporting ships, east of Suez. This Fleet will have the fighter and strike aircraft necessary to protect itself and to support ground operations. It will also be able to deal with any submarine threat in the event of a limited war in the area. The ability of this Fleet to give assistance, where needed, will be reinforced by the provision of a commando carrier. This carrier will be able, by means of its helicopters, to land its commandos far inland. This Fleet will be based on Singapore.

In the Atlantic and Mediterranean the interests of the United Kingdom, and of the other countries of the North Atlantic Treaty Organization, centre largely on the control of the oceans around which they are grouped, and in view of the growing strength of the Russian submarine fleet, it is proposed that the Royal Navy's contribution to NATO should be predominantly in the anti-submarine rôle.

It is intended to have two aircraft carriers at sea in the NATO areas with a third in immediate reserve. The carriers will be supported by two cruisers and by a number of destroyers, frigates and submarines.

Aircraft Carriers. The carriers in service at present are *Eagle*, *Ark Royal* and *Bulwark*. During 1958 *Ark Royal* and *Bulwark* will be replaced by *Victorious* and *Centaur* (now being modernized). To follow the general policy described above, *Bulwark* will be deployed east of Suez during 1958, until relieved by *Albion* (presently refitting) at which time *Bulwark* returns for conversion to the rôle of commando carrier. *Victorious* is undergoing sea trials after being virtually rebuilt in Portsmouth Dockyard. When she joins the Fleet in August 1958 she will be one of the best equipped carriers in the world. She has a fully angled deck, steam catapults and the most modern landing control system. Her electronic equipment is of the most advanced design. It includes a high-powered radar set which can detect aircraft targets at considerable range and show their position simultaneously in range, bearing and height. With this radar set goes a new display system which makes it possible to clarify the airborne target situation quickly and easily. This will enable her to exploit to the full the capabilities of the latest and next generations of naval aircraft. This combination is unique and believed to be in advance of what has been achieved in other Navies. In due course *Hermes* (at present under construction) and *Eagle* will be of a similar standard.

Aircraft. The Fleet Air Arm has maintained its essential high standard of performance, the value of which was recognized by all who saw it during the autumn NATO exercises last year. It was stated last year that the twin-engine fighter, the Scimitar was expected in the Fleet by the middle of 1958: the first front-line squadron will form in June and will embark in *Victorious* in September. The Scimitar (the Navy's first swept-wing aircraft) will in due course replace the Sea Hawk. Although primarily an intercepter fighter it can also serve in a strike capacity. After the Scimitar will come the all-weather Sea Vixen fighter which is destined to be the principal weapon of the long-range air defence system of the Fleet.

Westland Wessex.

The Sea Vixen is to be armed with air-to-air guided missiles and rocket batteries, and fitted with interception radar installation. A service trials flight will be formed later this year. This aircraft will replace the Sea Venom, over which it has a very much improved all round performance. The guided missile Firestreak, which this aircraft will carry, gives a greatly increased destructive power.

The NA.39 will give the Fleet Air Arm the long-range strike weapon which it has long desired. It is expected that the first of the development batch now under construction will fly this year.

Helicopters will be increasingly used to find, fix and destroy submarines, and it is planned to order more. British-built Whirlwinds came into service in the second half of 1957; a squadron is already embarked, and others are being formed. The Wessex, a more powerful helicopter with a heavier load-carrying capacity, is under development as a replacement for the Whirlwind.

de Havilland Sea Vixen.

Royal Marines and Commando Carrier. When *Bulwark* returns from her tour in the Far East she will be taken in hand for conversion to a commando carrier. On completion she will be deployed East of Suez. A full-strength commando will be available, which the carrier can quickly transport and land complete with equipment, wherever required. The commando carrier's helicopters will also be able to disembark the commando's vehicles. She will have on board sufficient stores and fuel to support the commando in active operations ashore, and could re-embark the unit speedily when required. This will be the first ship of its kind to be commissioned in the Royal Navy. It will not only reinforce the traditionally close association of the Corps of Royal Marines with the Navy, but will give these versatile troops greater mobility and usefulness, and enable them to be fully self-supporting. The commando carrier will be fully convertible to the anti-submarine rôle. It will be able, at short notice, and entirely within its own resources, to adapt its helicopters for anti-submarine work.

Guided-missile Ships. The trial firings of Seaslug—a ship-to-air weapon—in H.M.S. *Girdle Ness* have continued, and have achieved a marked degree of success. Seaslug may also be capable of development as a ship-to-ship weapon. Four guided-missile destroyers have been ordered, and for these it is proposed to revive the County Class names—*London*, *Hampshire*, *Devonshire*, and *Kent*.

Home Air Command. The tasks of the Home Air Command will be concentrated in larger groups at fewer bases. Six air establishments will be closed over the next three years, in addition to the air stations at Anthorn and Stretton, which are already closing. Planned dates of closure are as follows:—

Ford and Bramcote, early 1959; Eglinton, first half of 1959; Brawdy, 1960 (but to be kept in reserve); Worthy Down, 1961 (its task is to be transferred to Lee-on-Solent). Air establishments to be retained are (stations) Yeovilton, Lossiemouth, Culdrose, Abbotsinch, Arbroath, Lee-on-Solent; and (aircraft yards) Belfast and Fleetlands.

SERVICE AVIATION . . .

Lord Trenchard

The C.A.S. on his First Predecessor: Points from Sir Dermot Boyle's R.Ae.S. Lecture

DESCRIBING Lord Trenchard as "a giant amongst men—great in heart and mind as he was in stature," Marshal of the R.A.F. Sir Dermot Boyle drew a vivid portrait of his first predecessor as Chief of the Air Staff when he gave the first Trenchard Memorial Lecture at Halton on February 20.

Sir Dermot said he regarded it is a great privilege to give the first Trenchard Memorial Lecture—and that it was appropriate that the subject should be the life of the person in whose memory this series of lectures had been inaugurated by the Royal Aeronautical Society.

Any lecturer would be proud to have such a splendid subject, but its very magnificence imposed a great responsibility; and because it was impossible to do full justice to the man about whom he intended to talk he would concentrate on Lord Trenchard's work in relation to the R.A.F. and merely touch on his other activities sufficiently to emphasize how diverse and effective they were. His was not one career but many—and he left his mark on them all. He was soldier, colonist, airman, policeman and business man. Before ever he became an airman he had a career behind him in the Army of which many a man would have been content to boast in retirement.

Although it is with the airman that we are now mainly concerned, said Sir Dermot, some background of his early life would not come amiss. Commissioned into the Royal Scots Fusiliers in 1893, he served in India until the South African War brought him to action. He fought with all "sorts and kinds of irregular forces"—Imperial Yeomanry, Australian Bushman Corps and the Canadian Scouts. Soon after being promoted captain in 1900 he was severely wounded in the lung. Out of action for several months, he nevertheless returned to the fray, this time with the mounted infantry in the Transvaal, Orange River and the Cape Colony.

In 1903 he was seconded as a brevet major to the West African Frontier Force and thus began his great interest in, and knowledge of, the problems of West Africa. His service in Nigeria was notable; he received the D.S.O., was twice mentioned in despatches and had command of the Southern Nigeria Regiment from 1908-1912. Then he was invalided back to the U.K.

At this point, a lesser man's military career might well have ended—extremely honourably; but Trenchard was too energetic to retire and, indeed, never did so. While his applications to return to another overseas post were being considered in the War Office, the death in a flying accident of an old friend turned his mind towards this new field. In view of his age the War Office gave Trenchard ten days to learn to fly, so he took himself to Brooklands to the School run by T. O. M. Sopwith. He passed his tests within about a week and took his Certificate on August 13, 1912, in a Farman. Six months later was his 40th birthday, and he would have been too old for the new Service; one cannot imagine how the Air Force would have fared if it had been so arbitrarily deprived of so great a champion.

Trenchard went to the Central Flying School expecting to be a student but was surprised to find himself appointed Chief Staff Officer. He owed his new position in great measure to being a Brevet Major and, on looking up his duties, discovered that among them was the setting of the examination and deciding whether or not those who sat for it had reached the required standard. Within a fortnight he had set himself papers on aerodynamics and the mechanics of flying, had examined himself and declared himself to have passed. Thereafter he was wont to observe that, as long as he was at the School, he was determined to maintain the same high standard in all examinations.

In his flying instructor, Lt. (later Air Chief Marshal Sir Arthur) A. M. Longmore, R.N., Trenchard found a friend ready and eager to give him the experience he sought. The two men flew as many hours together as they could snatch from their duties.

Marshal of the R.A.F. Lord Trenchard—the portrait by Vertilleux which hangs in the Air Council room at the Air Ministry.

Thus it was that Hugh Trenchard was closely associated with the very cradle of the R.A.F. right back in those early days of the C.F.S. By the outbreak of the Great War a large proportion of R.F.C. officers had passed through his hands. The efficiency of the Flying Corps, at that time and in its own way another of the irregular Forces towards which Trenchard always seemed to be drawn, was to become the efficiency of the R.A.F.

Perhaps one thinks of Trenchard as an administrator rather than a flyer; yet in those early days, with records being made and broken almost weekly, Major E. L. Gerrard and Trenchard together reached 10,000ft and broke the British height record.

When war came the existing squadrons hurried off to the front and in a short time there remained practically nothing in the way of aircraft or pilots in the country. Col. Trenchard, as he then was, stayed behind at Farnborough in charge of the Administrative Wing of the R.F.C. But he did not remain there for long, for with the reorganization of the R.F.C. in France he was given command of No. 1 Wing at St. Omer in November; and in August 1915 succeeded General Henderson in overall command.

At a time when the race for air superiority was just beginning, and both sides were producing faster and better aircraft one after the other, Trenchard knew that success depended on the pilots' continued high morale. In his view, "improvements in mechanical science, to be of any use in war, depend on the skill and practice of those who use them."

His friend Haig, the great soldier, and Baring, the poet and diplomat, give us an insight into Trenchard's character. As a man of strong purpose he admired others like himself, whatever their sphere of activity. That he was not a romantic but a true warrior is clearly borne out by his inherent belief in the spirit of the offensive in the air.

This was perhaps one of his greatest services to the Air Force. It was apparent in the early months of 1917 when, despite the high casualties which might well have struck at the very morale of the Service, he continued to maintain and foster this aggressive spirit in his pilots—a spirit which was the strength of the Royal Air Force in the last war and one which has never died.

The programme of expansion that Trenchard advocated would have ensured immediate superiority for the R.F.C. in France had it been properly fulfilled; but it was subject to continual postponement and disappointment. It was not until 1918 that the R.F.C. felt the full benefit of these far-sighted schemes; but in January of that year Trenchard was recalled from the Western Front to be the first Chief of the newly created Air Staff. Sir Douglas Haig regretted his departure strongly although he realized that such an appointment was in the best interests of the country. It was, in fact, the bond between these two men which nearly brought Trenchard's career to an abrupt end just as it was reaching its peak. After a disagreement with the Secretary of State for Air, Lord Rothermere, Trenchard was forced to resign; for he preferred to stand by his loyalty to Haig rather than to play pawn in politics.

Although the Air Force lost its new-found leader for a short time it was not deprived of his services. The war had still to be won and in June 1918 he returned to command the Independent Air Force which was designed for the bombing of the German Homeland. As this new Force grew and became the Inter-Allied Independent Air Force, so a new horizon of air operations came into view. This was the very genesis of strategic bombing.

It was one of those fortunate turns of Fate that Trenchard was induced to take up the reins as C.A.S. once again in April 1919 at a time when the very existence of the Air Force as a separate Service was at stake. It was then that the great work of building up a Regular Air Force began. Formed by the amalgamation of the R.F.C. and the R.N.A.S., the new force was practically a war creation on a temporary basis in which no count had been taken of the possibility of its becoming permanent. "The force may, in fact, be compared," said Trenchard in his famous memorandum of 1919, "to the prophet Jonah's gourd. The necessities of war created it in a night but the economies of peace have to a large extent caused it to wither in a day, and we are now faced with the necessity of replacing it with a plant of deeper root. As in nature, however, decay fosters growth, and the new plant has a fruitful soil from which to spring." Our Air Force today and indeed the Air Forces of the world are founded squarely upon Lord Trenchard's memorandum; its provisions and far-sighted policy for training and organization are still the backbone of Air Power.

Training was the first need of the new Force and he saw that a fine regular cadre of officers and men was essential so that expansion in time of war could be quickly accomplished and yet provide a well-balanced Air Force of ability. One of the ways of providing this cadre was effective schools. The Cadet College at Cranwell was opened in 1920, followed by the School for Apprentices at Halton and the Staff College (now at Bracknell) at Andover.

But in addition to training, research is an essential ingredient if an Air Force is to be efficient on a long-term basis. This Trenchard fully realized; and the arrangements he made were destined to produce the four-engined bomber, the high-speed fighter and radar, all of which when combined with crews of great quality brought this country to victory in the Second World War.

This organization, however, was not enough; the R.A.F. had to establish itself in a peacetime rôle. Mr. Winston Churchill, who with Trenchard had seen unmistakable evidence of the power of air control in Somaliland in 1919 when

he was Secretary for War and Air, was faced with continual demands for the reduction of the enormous expenditure required for control of the Mandated Territories in the Middle East, which had been put under our administration after the war.

Great difficulties were being experienced with the control of unruly tribesmen in these Territories—particularly in Iraq, where in one year alone 92 units of British and Indian troops and four Air Force squadrons costing many millions of pounds were needed to maintain order. The Cairo Conference of 1921 accepted the "control without occupation" of Iraq, which eight squadrons of the Air Force could maintain at a fraction of the cost and with a total of only 12 Army units.

So was the R.A.F. established in the face of opposition and at this time (1922) another name, famous in air history, arose to work side by side with Trenchard over seven hard years —Sir Samuel Hoare, newly appointed Secretary of State for Air. He took over, however, despite the warning of the Prime Minister that the job might only last for a few weeks. Viscount Templewood, as he later became, has paid the greatest tribute to Lord Trenchard—calling him the "Prophet" and giving himself the position of "Interpreter."

An earlier battle, not in war but yet of great significance in the days of the struggle for the unity of the Air Force, was the battle for the control of naval flying. The Royal Navy wished to have control of all that was on or over the sea but to the new Air Force such a division of responsibilities would have been a death blow. Beatty, the powerful, persuasive speaker, the most popular of naval leaders, seemed an impossible opponent for Trenchard, the slow speaker, the gentle man. And yet, one by one, men of naval background like Salisbury and Balfour, who might well have supported the Navy's claim for a naval Air Service on principle, were impressed by Trenchard's sheer honesty and his dedicated belief in the unity of air power. Finally, it was agreed that the Air Force should control carrier-borne aircraft, the Fleet Air Arm: that lasted until, as a result of the Inskip Committee in 1937, they reverted to the Navy again.

The difficulties of liaison between the three Services were well known to Trenchard; and the now well-established Chiefs of Staff Committee was his answer to the problem of co-ordinating Navy, Army and Air Force to produce joint briefs for the Government.

The Salisbury Committee of 1923 had reaffirmed the R.A.F. as a permanent and separate Service and its recommendations as to the size of the Force gave Trenchard and Sir Samuel Hoare the task of building up the 52 squadrons that it required for home defence and of reviving the organization which had been in a state of suspended animation since the end of the war. While Hoare fought for the money, Trenchard worked to put his ideas (already expressed in his memorandum of 1919) into effect.

Doubts and difficulties lay in all directions around the R.A.F. in the 1920s. It lacked the maturity which promotes tradition. Such tradition had to be fostered in the new Service and, little by little, through the fight for a distinctive uniform and its own rank titles, the Royal Air Force emerged.

Creation of "esprit de corps" was undoubtedly a problem, when both officers and men had to move constantly from unit to unit and where there was not the continuity of background of the Army regiments. Nevertheless, by dint of careful selection of commanding officers, by such simple things as distinctive markings of the aircraft of operational squadrons and the granting of heraldic squadron badges, by healthy inter-squadron competition in the air and on the sports field, a truly remarkable "esprit d'escadrille" was created.

But Trenchard well knew that his handful of expert professional airmen would be far too few to carry out the tasks which he knew his Air Force would one day be called upon to perform. One of the answers which he found was the Auxiliary Air Force which he planned as an élite company of adventurous young men rather like the old mounted yeomanry of his younger days. Whereas with the yeomanry the connection had been territorial, by counties, with the Auxiliary Air Force it was to be linked with industrial towns and cities like London and Nottingham, Manchester and Birmingham. They were to have fine headquarters and plenty of social life and provide trained squadrons for the R.A.F. in time of need. They were to have and did build a tradition which was all their own—a fine tradition which, like that of the Regular Air Force, withstood the decisive test of war. In the universities, too, Trenchard planned squadrons for basic training in aviation in a non-military way, which brought the right men to a consciousness of the great future in the air.

In fact, the country slowly began to realize that air power and the Royal Air Force were here to stay. The prejudices were broken one by one. Trenchard was the prophet, planner and—though he hated to be called it—the "father" of the Royal Air Force. In 1927, he became the first Marshal of the Royal Air Force and, with that promotion, the Air Force itself was promoted into definite equality with the Royal Navy and the Army.

On January 1, 1930, Trenchard relinquished his appointment as Chief of the Air Staff after eleven long years; but he was soon back at work again, this time as Commissioner of the Metropolitan Police—an arduous and responsible position which he filled for four years and to which he brought all his vigour and enthusiasm for organization. The Police College and the Forensic Laboratories were amongst his innovations, together with many improvements.

Time does not permit (concluded the C.A.S.) mentioning Lord Trenchard's many activities during and since World War II; but he continued to take a great interest in everything that mattered, especially the Royal Air Force, to the very end of his life.

He died on February 10, 1956, and his remains were laid to rest in Westminster Abbey in the presence of a distinguished company gathered together to do honour to a great man —a man whose foresight, determination and singleness of purpose forged the weapon which saved this country from defeat in 1940, and made victory possible five years later.

Transatlantic Lecturer

FOR the second successive year Air Chief Marshal Sir Thomas Pike, A.O.C-in-C. Fighter Command, has ben invited to lecture to the U.S.A.F. War College at Maxwell A.F.B., Alabama (on March 7); and to the R.C.A.F. Staff College at Toronto (on March 10). His subject will be *The Air Defence of the United Kingdom.*

W.R.A.F. Director's Tour

DURING a current tour of M.E.A.F. units the Director of the W.R.A.F., Air Commandant M. H. Barnett, is meeting members of the Maltese section of the W.R.A.F.V.R. and of the W.R.A.F. medical staff at El Adem, and visiting W.R.A.F. personnel stationed in Cyprus and at Aden, where she is concluding her tour on March 8.

Transport Command Appointment

FORMERLY A.O.C. Ceylon (from May 1955) and prior to that Group Captain in charge of Administration at Flying Training Command, A. Cdre. H. W. Mermagen has become A.O.A. at Transport Command headquarters. During the war he commanded a Spitfire squadron, No. 222, operating over Dunkirk and in the early stages of the Battle of Britain; and his appointments have included those of Deputy A.C.A.S. at S.H.A.E.F. and Air Adviser to the U.K. High Commissioner in Australia. He was awarded the A.F.C. in 1940 and was made O.B.E. in 1941 and C.B.E. in 1945.

The "Benson Experiment"

DETAILS of improvements in R.A.F. station administration resulting from what is known as the "Benson experiment" were given recently by the Secretary of State for Air, Mr. George Ward, in a written Parliamentary answer. He stated that its general aim had been to raise morale by simplifying and liberalizing administration wherever possible without undermining discipline or efficiency; as a result, a number of changes had been introduced. These included a great reduction in parades of all kinds; simpler procedures for airmen arriving at or leaving a station on posting; the issue of subsistence allowances instead of haversack rations; wearing of plain clothes by airmen in dining-halls when they are off duty; and the withdrawal of much of the webbing equipment formerly issued to airmen.

The Duchess of Gloucester, Air Chief Commandant of the W.R.A.F., presenting the Sash of Merit to Off/Cdt. P. M. Sayer at the passing-out parade of W.R.A.F. officer cadets at R.A.F. Hawkinge on February 18.

R.A.F. Postings

AMONG appointments recently announced by Air Ministry are the following:—

W/C.s E. J. Brooks to R.A.F. Rufforth, to command; H. D. Campbell to H.Q., Coastal Command, for administrative staff duties; R. E. W. Harland to Ministry of Supply, for duty in the U.S.A.; C. R. C. Howlett to H.Q., Fighter Command, for technical staff duties; L. J. Joel to the Ministry of Supply, Boscombe Down; P. A. Kennedy to R.A.F. Wildenrath, to command No. 31 Squadron; A. McArthy to R.A.F. Linton-on-Ouse, for technical duties; A. D. Rutherford-Jones to No. 114 M.U., Aden, to command; Acting W/C. A. Mackleden to R.A.F. Jever, for technical duties.

S/Ls. Batchelar to H.Q., No. 11 Group, for air staff duties (with the acting rank of wing commander); and D. N. Shepherd to R.A.F. South Cerney, to command No. 1 Wing (with the acting rank of wing commander).

R.F.C./R.N.A.S. Reunion

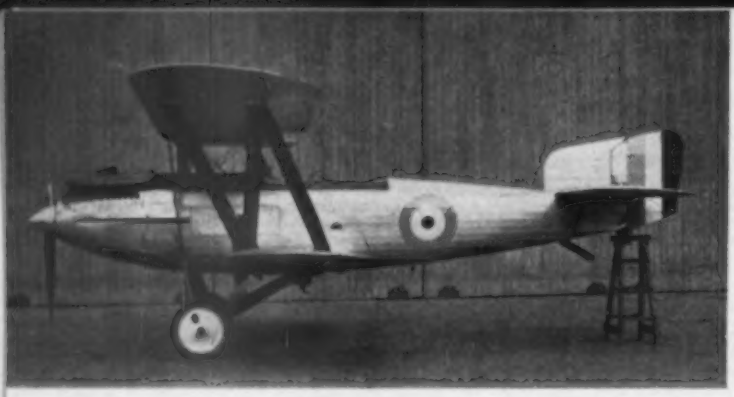
ON March 31, fortieth anniversary of the termination of the R.F.C. and R.N.A.S., the R.F.C./R.N.A.S. Club at Brighton is holding its 8th annual dinner and dance in the Royal Pavilion. A few tickets (21s) are still available and can be obtained from Capt. R. F. Tindall, 48 Surrenden Road, Brighton 6 (Tel. Brighton 58022).

IN BRIEF

The Duke and Duchess of Gloucester are to attend a dinner at Fighter Command headquarters, Stanmore, on April 1—the 40th anniversary of the creation of the R.A.F.

* * * * *

Fighter Command is giving the R.A.F.'s principal display—"Missile Defence"—at this year's Royal Tournament, which is being held from June 4 to 21 at Earls Court, London. Action at a guided missile station following an "alert" will be simulated.



The Fairey Fox (as famous for its good looks as for its speed) referred to in the note in column 1 by Mr. Massey Hilton.

Correspondence

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns; the names and addresses of the writers, not for publication in detail, must in all cases accompany letters.

Deck-landing the Fox

IN outlining the career of Mr. L. Massey Hilton, D.F.C., A.F.C., A.F.R.Ae.S., in your issue of February 14, on the occasion of that gentleman's retirement from the board of the Fairey Aviation Co., Ltd., you mentioned that among the trials he carried out were deck-landings with the Fairey Fox. I believe I am right in saying that this is the first mention of that event to have been made in print, and I for one should be glad to have details.

London, W.1. EX-F.A.A. PILOT.

[Invited to provide particulars, Mr. Massey Hilton writes:—

"The landings took place in June 1926 in H.M.S. *Furious* (Captain Preston, R.N., and W/C. L. H. Busteed as Commander Flying). Two landings were made on June 3 in the area off the Isle of Wight. Wind speed over the deck was 35 kt and length of landing runs 92ft and 42ft. Six further landings were made on June 7, the deck airspeed varying from 33 to 38 kt.

"There were no wires or arresting gear of any sort on the deck and, with no brakes and a steel-shod tail skid, it was essential to keep the aircraft dead straight. The aircraft controls were good, right down to the stall, although heavy at high speed. The view forward was very poor and the photograph I enclose [reproduced above] will illustrate this. The aircraft was Fairey's precious prototype, so you can well understand their absorbed interest in its safety!

"I had long been claiming that there was too much 'black magic' surrounding deck landing, and given good controls and good view we could accept a higher-performance aeroplane for general usage."—Ed.]

Restrictions on the Private Pilot

PRIVATE pilots, I am sure, are grateful to you for opening your columns to a most interesting discussion on the privations which they suffer in this country. But let me assure your readers that indignation does not mean hate. If we look on the M.T.C.A. and their restrictive regulations repressively applied as the primary reason for the poor state of private flying in this country compared with America or the Continent, I am afraid we have cause.

Those of us who remember the days when Sir Sefton Brancker was Director of Civil Aviation cannot help contrasting the active, practical and friendly interest he took in our problems with the cold, legal attitude of today. Lately, I am very pleased to say, there have been small signs of better things from Berkeley Square. The Joint Users' Scheme with the R.A.F. will long remain a monument to whoever planned it. Letters from the Ministry are written in a slightly warmer tone of Civil Service jargon. But, oh, what a long way these gentlemen have to go before they realize that their job is not merely to "keep their yardarms clear" (a naval expression meaning thinking more about avoiding blame than doing one's duty), but to carry out the injunction to encourage civil aviation as given in the preamble to the Act of 1949, and to remember that civil aviation does not consist only of the big airlines but also of the many little aeroplanes. They may even realize that in the future it is just these little aeroplanes for which, one day, there will be a world market of the same relative importance as that for motor cars today; and if, occasionally, they would get off their office chairs and go abroad, they would see it already developing.

Claygate, Surrey. NORMAN JONES.

THE correspondence regarding restrictions on the private pilot, and ultra-light aircraft development, emphasizes what restrictive thought and practice can achieve in extinction of a sport—or, for that matter, anything else. The proof of the pudding is in the eating. Why are there virtually no British ultra-lights or privately conceived aircraft flying today? There is a very good reason.

Since the days of the Lympne trials, and a short subsequent era, the ultra-light has virtually been killed stone dead in Britain by the restrictive attentions of those who might have been expected to help the movement by personal and official encouragement. Nowadays no one but a millionaire can build or produce his "motor cycle of the air" for just-fun flying, nor may he fly it without costly tuition, although it was proved in the early days that any average intelligent person can get the rudiments of slow flying in an hour or two, just as a man can sail a dinghy in a very short period, polishing up the finer stuff by later experience.

Yachting should have taught the apprehensive aircraft official mind how unrestricted effort by enthusiasts can create a massive movement in experiment and vital interest, all to the good of the nation, with no officialdom to hamper it. This unrestricted boat movement has grown to vast proportions during the past few years, and has thereby created a huge trade interest and employment for many people. If some Ministry were to get hold of this movement with the dead hand of petty restriction, "in the interest of safety," the movement would be killed.

At one time, around the thirties, it looked as if the ultra-light aeroplane movement would flourish in spite of the relatively unsuitable motor-cycle engines available at that time, but unfortunately officialdom stepped in, with many people employed to think up new regulations to protect everyone from possible risk, and the thing died in Britain, but not in other countries.

This danger bogy is quite absurd, for when an airliner crashes (and it does on occasion) a whole row of houses may be wiped off, whereas if a popbottle aircraft were to crash a slate or two might be chipped on one house. The airliner must fly over houses because large airports are situated with buildings thick around them; but the popbottle aircraft, for fun flying (like dinghy sailing), need not fly over crowded dwellings, nor need it fly in tough weather any more than a dinghy sailor wants to sail in really unsuitable weather miles away from home shelter. The whole approach of fun flying for the impecunious youngster has been approached from the wrong angle by the rutty-minded restrictive Powers that Be.

I can never understand how it has come to pass that all the great aeronautical firms in this country were started off by enthusiastic amateurs, and how these people could have then let the years go by without taking a little time off, and spending a few pounds from time to time, to develop a safe baby as a study in the sadly neglected art of slow speed flight on low power, just for the pure fun and enthusiasm for flight.

Bournemouth, Hants. C. E. BOWDEN, Lt-Col.

[This controversy has had a generous airing and, unless any letters of exceptional interest are received, no further space can be devoted to it—Ed.]

"Armageddon—or?"

YOUR correspondent J. Lawrence Pritchard [January 31] quotes Henry Adams as prophesying the human race blowing up the world, being able to cruise in space, and changing the rotation of the Earth.

Surely Henry Adams was drawing on his Old Testament knowledge of what Nahum said in 713 B.C. about the mountains quaking and the burning of the earth, what Ezekiel said in 514 B.C. about living creatures moving with four wheels with one likeness as if a wheel had been in the midst of a wheel, and what Daniel said in 603 B.C. about changing times and seasons.

Holywood, Co. Down. A. HUGH FINLAY.

FORTHCOMING EVENTS

Mar. 1.	British Interplanetary Society: "Guidance and Control of Long-range Vehicles," by Prof. G. A. Whitfield.
Mar. 1.	Society of Engineers: "The Saunders-Roe Pulsejet Engine," by C. E. Tharratt.
Mar. 5.	R.Ae.S.: Eleventh Louis Blériot Lecture, in Paris: "The Future of Aeronautical Research," by Prof. W. J. Duncan.
Mar. 7.	Helicopter Association: "Some Ways of Obtaining an Integrated Aircraft," by Dr. D. Kuchemann.
Mar. 9.	Nairobi Airport: Air Display for official opening.
Mar. 13.	R.Ae.S.: Main Lecture at Christchurch Branch: "Flight Tests of a Meteor Aeroplane fitted with Jet Deflection," by P. F. Ashwood and D. Lean.

R.Ae.S. Branch Lectures (to March 13):—

Feb. 28. *Birmingham*, Branch President's Night. Mar. 3. *Cheltenham*, "Investigation of Flutter and Vibration on Aircraft," by W. G. Molyneau; *Derby*, A Propulsion Symposium; *Henlow*, "Nuclear Propulsion for Aircraft," by Prof. A. D. Baxter. Mar. 4. *London Airport*, 2nd Annual Dinner. Mar. 5. *Brough*, "Human Limitations of High Speed Flight," by W/C. P. D. G. V. Whittingham; *Reading*, "Industrial Efficiency," by H. S. Wilkinson. Mar. 6. *Isle of Wight*, "Transient High Acceleration and the Human Body," by W/C. F. Latham. Mar. 10. *Halton*, "Supersonic Aircraft and Missiles," by P. J. Duncton. Mar. 11, *Boscombe Down*, "Navigation and the Air Traffic Control Problem," by D. O. Fraser; *Glasgow*, "Next Generation of Civil Aircraft," by G. H. Lee. Mar. 12, *Chester*, "Investigation of Aircraft Accidents," by E. L. Ripley; *Gloucester* "Problems of the Large Helicopter," by Dr. G. S. Hislop; *Southampton*, "Future Developments with Satellite Rockets," by L. R. Shepherd; *Swindon*, A.G.M. and Viscount films; *Weybridge*, "Aircraft Production; Present and Future," by S. P. Woodley. Mar. 13. *Christchurch*, Main Lecture (see above).

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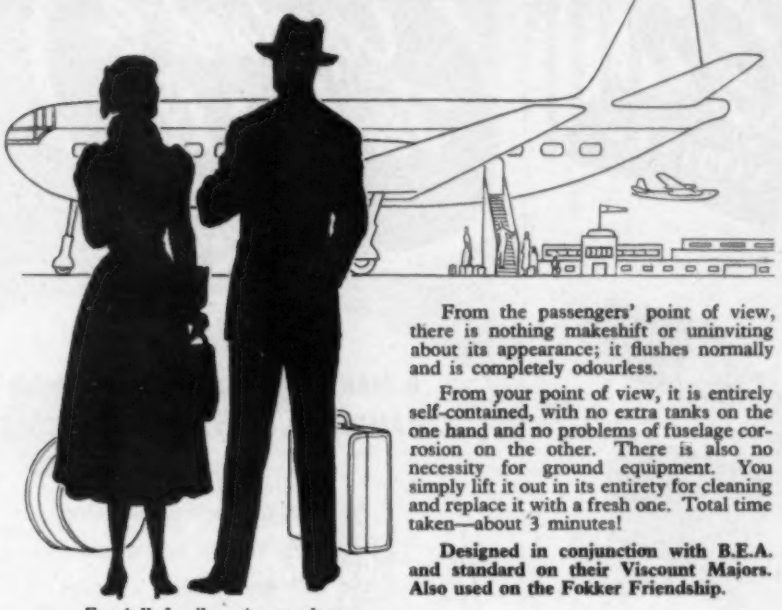

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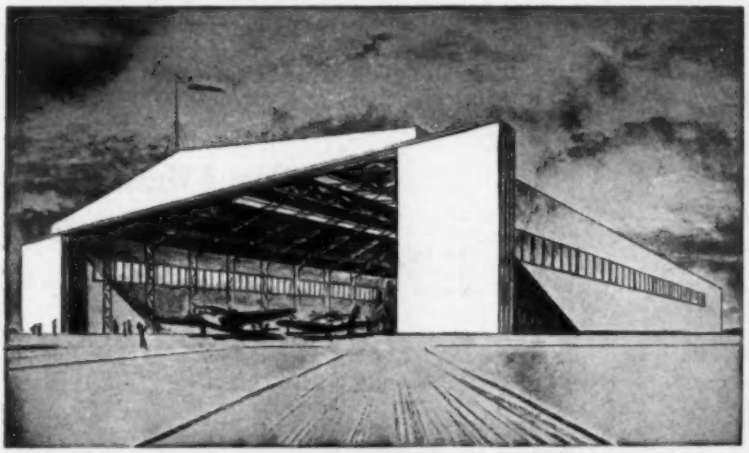

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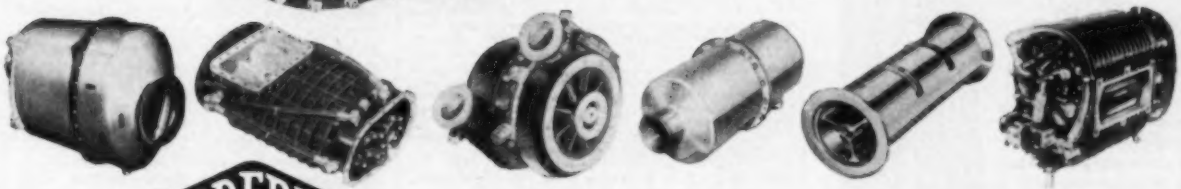

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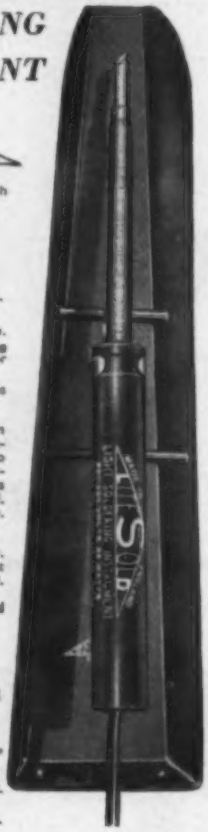

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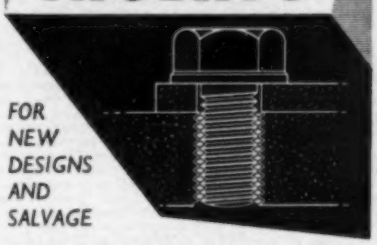

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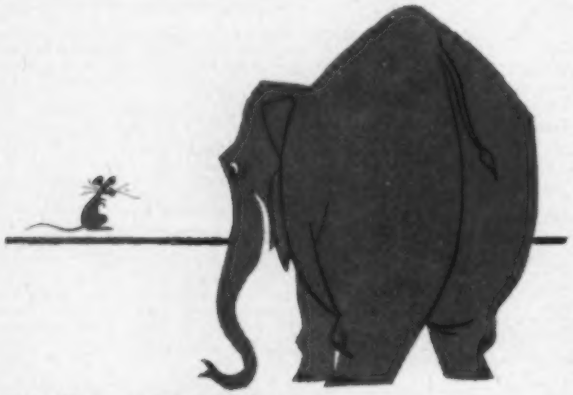

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For a year now, Britannias have been in service on BOAC's Commonwealth routes throughout half the world. Currently they are flying well over a million miles a month.

Powered by four 4,120-hp Bristol Proteus turboprop engines, the Britannia 310 cruises at 400 mph, carries up to 133 passengers and cuts operating expenses to a new minimum.

Britannias are in operation with BOAC, Aeronaves de Mexico and EL AL Israel Airlines. They have been ordered by Canadian Pacific, Cubana de Aviacion, Hunting-Clan Air Transport, Ministry of Supply, Northeast Airlines and the Royal Air Force.

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Britannia
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